APRIL 1953
PRICE 35 CENTS

ELECTRICAL CONSTRUCTION AND MAINTENANCE

WITH ELECTRICAL CONTRACTING



CADILLAC TANK *production uses armored cable 4800 volt distribution, bus for 480 volt power.*

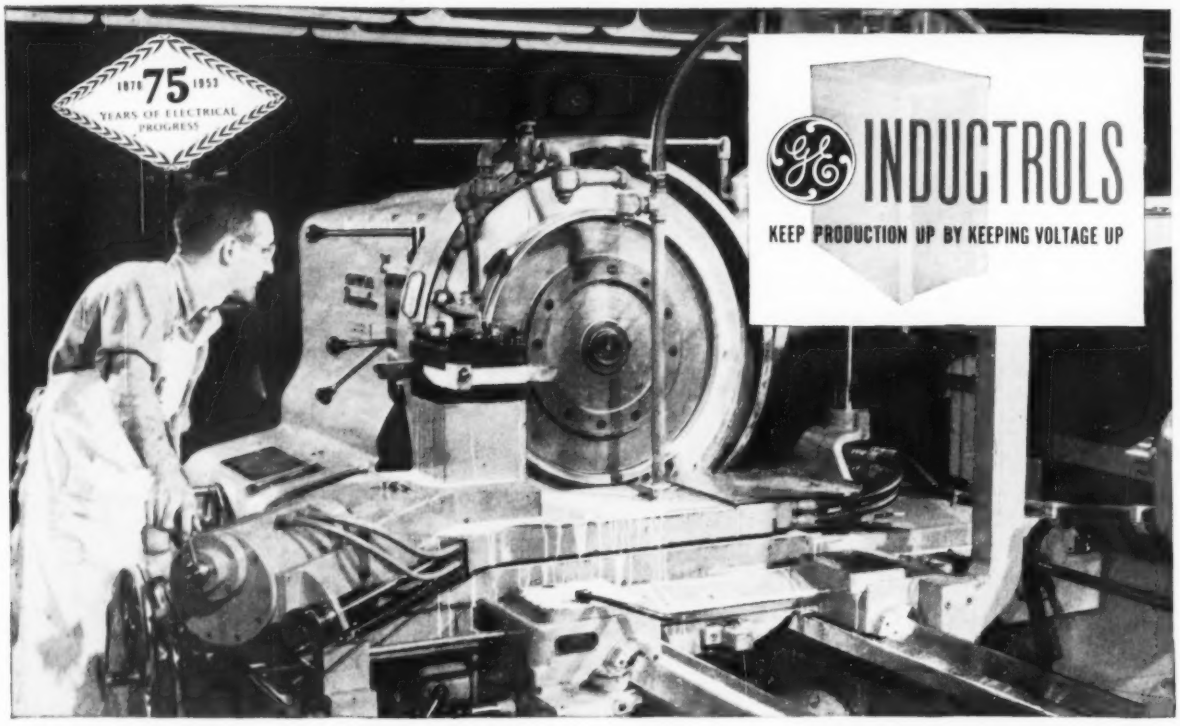


COVES AND COFFERS *are essential elements of many modern commercial lighting plans.*



CONTRACTOR KOHLER *of Hibbing lectures to estimating class at Winona, Minnesota.*

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Good Lamp Voltage Saves You Money!

Reduce lamp replacements . . . Maintain high production and quality workmanship with proper lighting.



G-E INDUCTROLS can be obtained for both manual and automatic operation, and both single- and three-phase circuits in sizes from 3 kva, 120 volts up to 500 kva, 600 volts.

Your plant lighting operates most efficiently at rated voltage. Undervoltage reduces the brilliance of all your lamps, and workmanship suffers. Overvoltage increases your lamp replacement costs.

That's why it pays to install G-E Inductrols. These new dry-type voltage regulators automatically maintain correct voltage for your plant lighting and other electric equipment, thus assuring peak operating efficiency. All-steel cabinets, attractively styled, protect personnel by completely enclosing all live parts.

For more information on Inductrols, contact your local G-E sales representative or authorized agent. Write for bulletins GEC-712, GEC-795 and GER-341, *General Electric Company, Schenectady 5, New York.* 404-90

HOW POOR VOLTAGE LIMITS YOUR PLANT EFFICIENCY

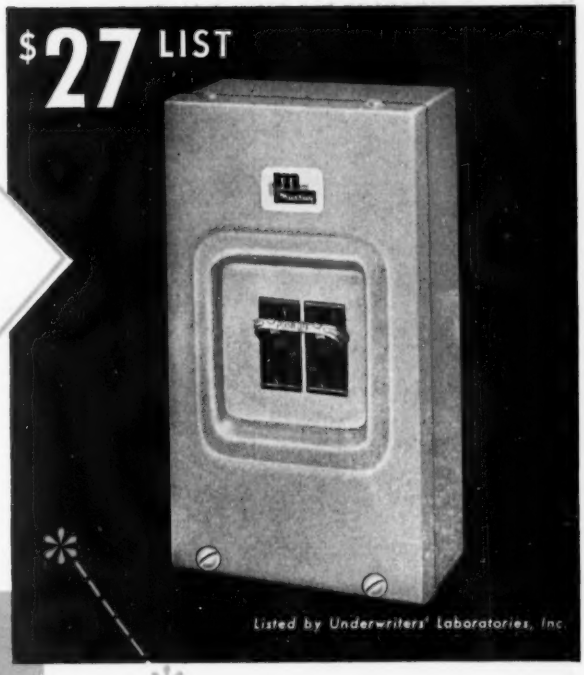
LAMP TYPE	10% Undervoltage	10% Overvoltage
Incandescent	Cuts light output 30%	Life cut 70%—Triples replacements.
Fluorescent	Cuts light output 10%; lamps may go out or fail to start.	Lamp life shortened drastically and unpredictably depending on frequency of starting, type of ballast, etc.
Mercury Vapor	Light output cut 15 to 25%; lamps go out with 15% undervoltage.	Even 5% overvoltage overheats lamp—shortens life. May damage lamp transformer.

G-E Inductrols are ideal for light-dimming applications

GENERAL ELECTRIC

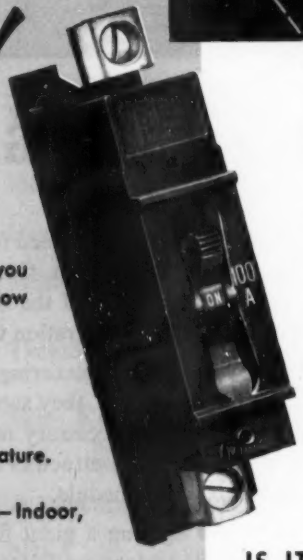
100 AMP. CIRCUIT BREAKER PROTECTION AT FUSE BOX PRICES

Another new Murray product



that gives you

Fully Magnetic! protection



LOW PRICE!

In the Murray 100 Amp. Service Control you get circuit breaker protection priced as low as comparable fused equipment.

MANY ADVANTAGES!

1. Fully magnetic circuit protection.
2. Carries full load regardless of temperature.
3. Plenty of room for easy wiring.
4. Compact (12-1/16 x 6-13/16 x 3-7/8—Indoor, surface type).
5. Easy to gang (No side handles).
6. Flush or surface mounting.

WHAT IS IT?

Service control equipment—3 wire, single phase, 120-240 Volts AC. Available in two types: 1—Indoor (surface or flush) or 2—Outdoor (raintight). Supplied with handle extensions for simultaneous manual tripping of two single pole independent trip fully magnetic circuit breakers in 70, 90, or 100 amps.

HOW IS IT USED?

1. Same application as a 100 amp. 3 wire fused switch with neutral or a 100 amp. 2 wire fused switch without neutral.
2. As Service Entrance Equipment.
3. As a main disconnect.
4. For protecting single phase lighting and appliance circuits or for fractional horse-power motor circuits.

IS IT AVAILABLE?

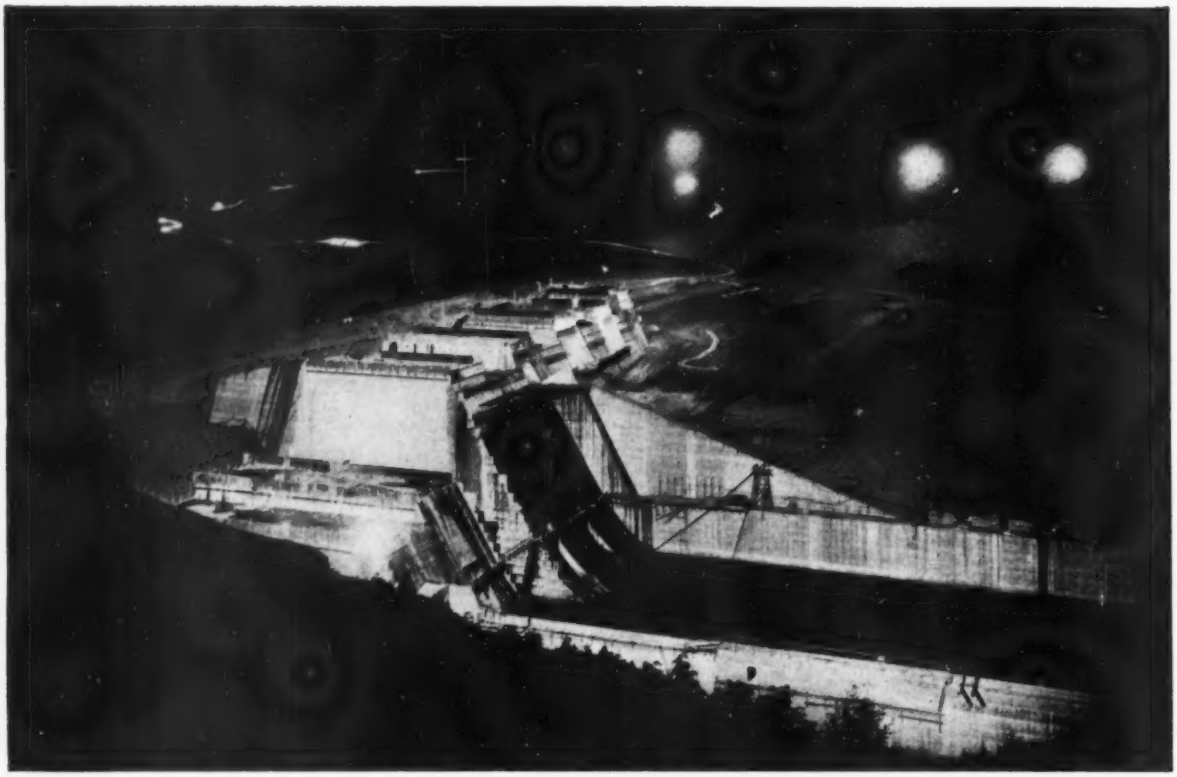
Yes! Call your distributor or contact your nearest Murray representative. Catalog numbers: Indoor—LV2IIA (Add S or F to indicate surface or flush mounting). Outdoor—LR2IIC (At slightly higher list price).

FOR DETAILED INFORMATION, WRITE:

MURRAY MANUFACTURING CORPORATION

1250 Atlantic Avenue • Brooklyn 16, New York

Service Entrance & Meter Equipment • Magnetic Circuit Breakers • Switches
Current Limiting Reactors • Crows'nest Aerial Ladders



THEY HAD TO KEEP WORKING DAY AND NIGHT

Out in the Pacific Northwest where the need for electrical energy is urgent, Morrison, Kiewit and Macco, Contractors, were faced with a tight schedule on the completion of the new Willamette River dam. They found that round-the-clock operation was their only answer.

Wesco came through with the kind of engineering assistance and quick delivery that was needed. In short order, they submitted recommendations for floodlighting, gathered the necessary material, rushed them to the dam site, and worked with the contractors night and day to help complete the installation ahead of schedule.

So with your job, whether it's lighting a giant flood control dam, or wiring a one-car garage, the Westinghouse Electric Supply Company stands ready to meet all your electrical needs.

Backed by the resources and experience of a nationwide organization, Wesco comprises 111 local business offices. Whatever your electrical problem may be — you can count on Wesco.

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A NATIONAL DISTRIBUTING ORGANIZATION

40 WALL STREET, NEW YORK, N. Y.

ELECTRICAL CONSTRUCTION AND MAINTENANCE

with which is consolidated Electrical Contracting, The Electrograph and Electrical Record . . . Established 1901

Published for electrical contractors, industrial electricians, engineers, consultants, inspectors and motor shops. Covering engineering, installation repair, maintenance and management, in the field of electrical construction and maintenance.

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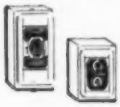
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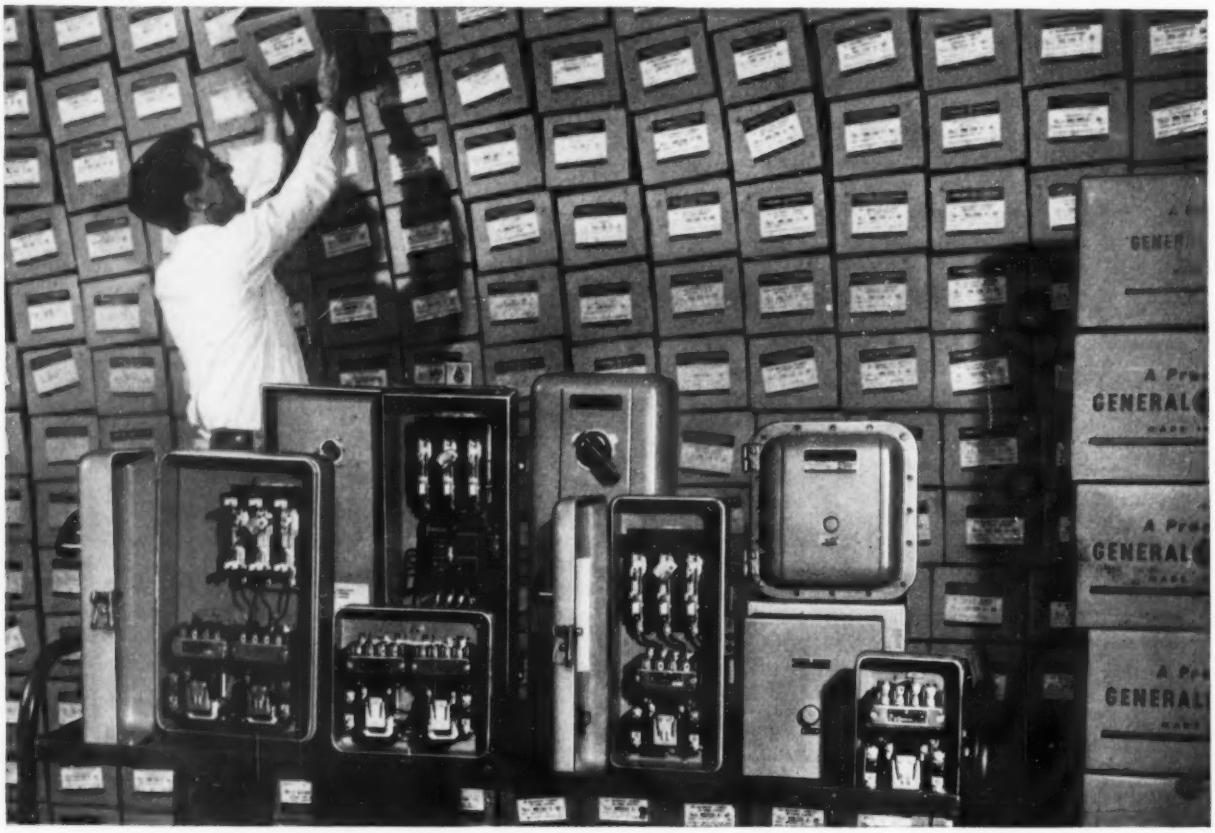

Fhp motor starter


1—7½ hp manual motor starters


A-c magnetic motor starter


Combination motor starter


Reversing motor starter



Meet Any Motor-Starting Application With A Dependable G-E Magnetic Starter

Thousands of Forms Available

No matter what your requirements, you can get a G-E starter to fit your application. Hundreds of variations of across-the-line, combination, reversing and multi-speed starters are available for a-c motors.

Every form pictured above has the same basic contactor that has proved its superiority again and again in severe industrial applications. You can choose from literally thousands of combinations of the contactor, shown at the right, and its accessory components, to get the best control for your particular motor application.

EXTRA INTERLOCK CONTACTS—as many as four on sizes 0 and 1, three on sizes 2 and 3—can be added to the standard starter for your application.

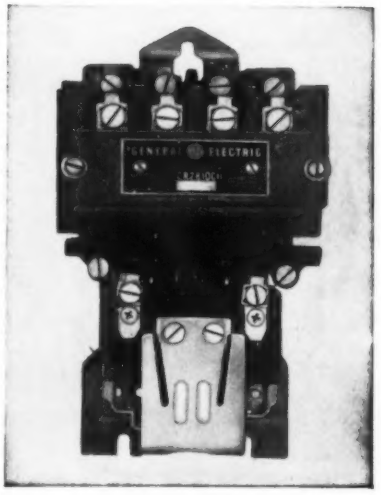
CONTROL TRANSFORMERS for operator protection, extra overload relay for motor protection, and control relays are available as standard components.

EITHER START-STOP push buttons or Hand-Off-Auto selector switches can be mounted in the starter cover.

ENCLOSURES for every motor application include general purpose, watertight, dusttight, semidust-tight, and explosion-proof. Enclosures that meet JIC specifications are also available.

ALL STARTERS have plenty of wiring space. Contacts, coils and overload relays can be removed quickly, conveniently.

Contact your nearest G-E apparatus sales office or authorized agent or distributor for your starters. Write for Bulletin GEC-880 for more details.



INFORMATION FOR CONTRACTORS-PLANT ELECTRICIANS

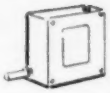

Reduced voltage starter

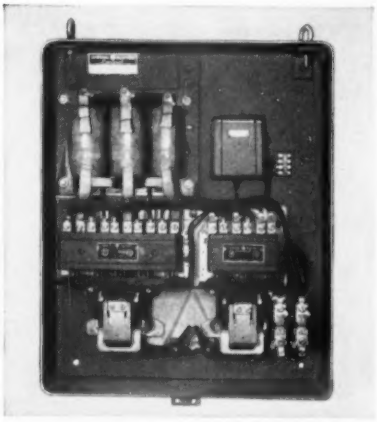

Heavy and standard-duty push-button stations


General-purpose relay


A-c and d-c solenoids


Roller-lever type limit switch

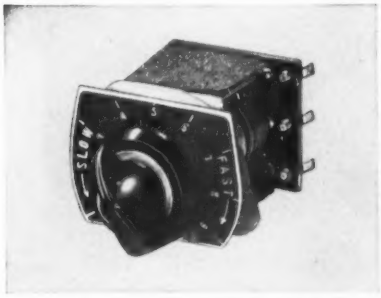

Rotating-type limit switch



G-E REDUCED-VOLTAGE MAGNETIC STARTER SOLVES POWER PROBLEMS

When load limitations prohibit motor starting at full voltage, this autotransformer-type starter controls and protects the operation of motor-driven pumps, conveyors, compressors, blowers, etc.

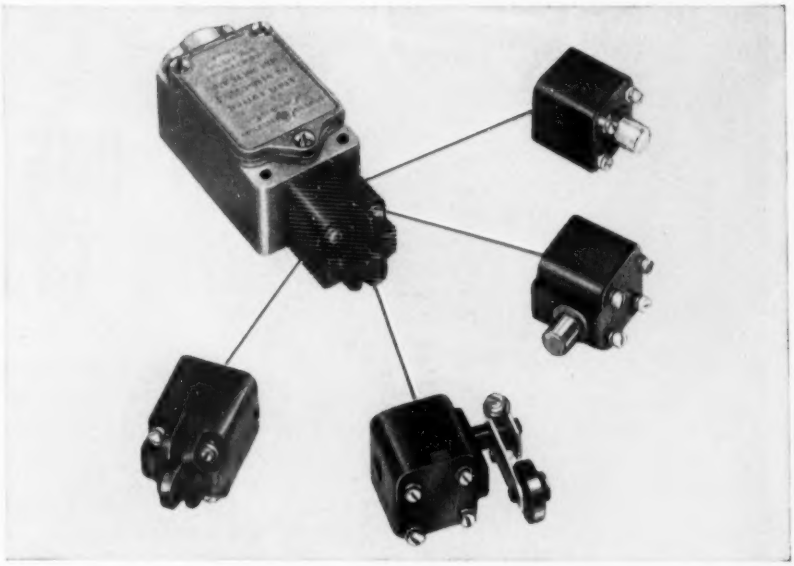
Available in air-break and oil-immersed designs, this hard-working starter for motors up to 250 hp utilizes the most modern materials and methods to give exactly the kind of operation you require for years to come.



NEW OILTIGHT POTENTIOMETER FOR CONTROL OF VARIABLE-SPEED MOTORS

This compact unit is part of the new G-E line of oiltight push buttons for use on a-c or d-c. It can be mounted in the standard G-E stations or enclosures or directly on the machine to be controlled. Ask for Bulletin GEA-5779 on the entire line of G-E oiltight push buttons.

SMALL G-E LIMIT SWITCH HAS FOUR INTERCHANGEABLE OPERATING HEADS FOR VARIETY OF APPLICATIONS



The basic contact unit—only slightly over two inches high—can be obtained with one of four different types of heads: roller lever, side pushrod, top pushrod, and roller pushrod. Case is oiltight—a gasketed cover keeps dirt and lubricating oils away from the contacts.

Little movement is required to operate it—18 degrees with a one-inch radius arm, 5/64 inch for the plunger type. Use this switch on machine tools, battery truck lift platforms, on small machines as a pilot device, and as a safety interlock on enclosing cases. Operates on a-c or d-c. Double-throw snap-action contact is easily accessible for wiring, and there is adequate room within the cast aluminum case for connecting to terminals, which are extra large. Bulletin GEA-5707.

NEW DUST-TIGHT/LINT-TIGHT G-E MANUAL MOTOR STARTER

For Motors Up to 7½ Hp

Listed by Underwriters' Laboratories and Factory Mutual, this starter for motors up to 7½ horsepower is completely dust tight. Special gaskets and cover fastenings keep dust from contacts—reduce the fire hazard. Two- three- and four-pole forms have bi-metallic overload relays with front-connected heaters. Switch lever moves to neutral position on overload, is vibration resistant.

Switch interior can be reversed in the enclosure for either top or bottom feed, and ON-OFF nameplate can be easily reversed.



For more information contact your nearest G-E representative, agent, or distributor, or write Section 730-45, General Electric Co., Schenectady 5, N. Y.

GENERAL ELECTRIC

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—for easier, faster surer taping jobs!



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High grade carefully compounded rubber with finest cotton base provides maximum mechanical protection. Standard and A.S.T.M. grades.



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Features high elasticity, excellent cohesion, high dielectric and super aging qualities. Available in Standard and A.S.T.M. — A.A.R. grades.



ACCURATE *PLASTIC* TAPE

Offers a bulk-reducing combination of thin caliper, good mechanical and dielectric strength. Recommended for use wherever plastic tape is practical.

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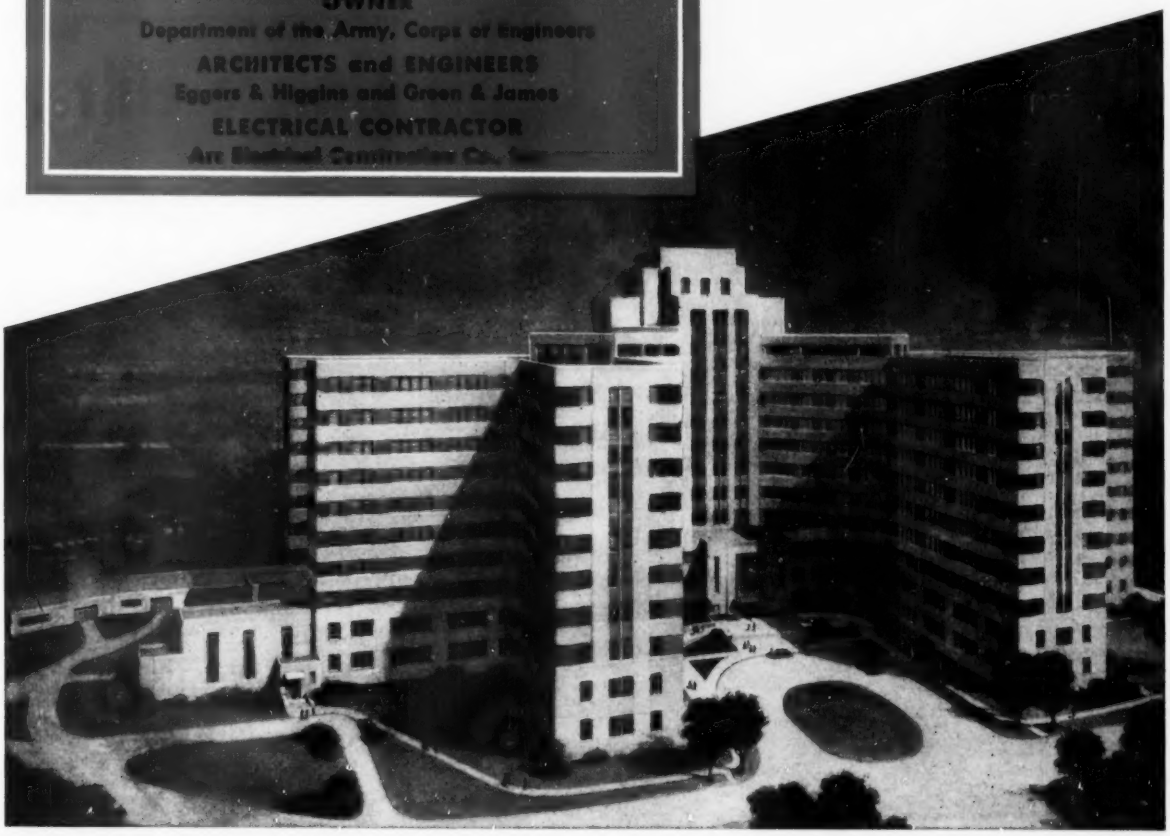
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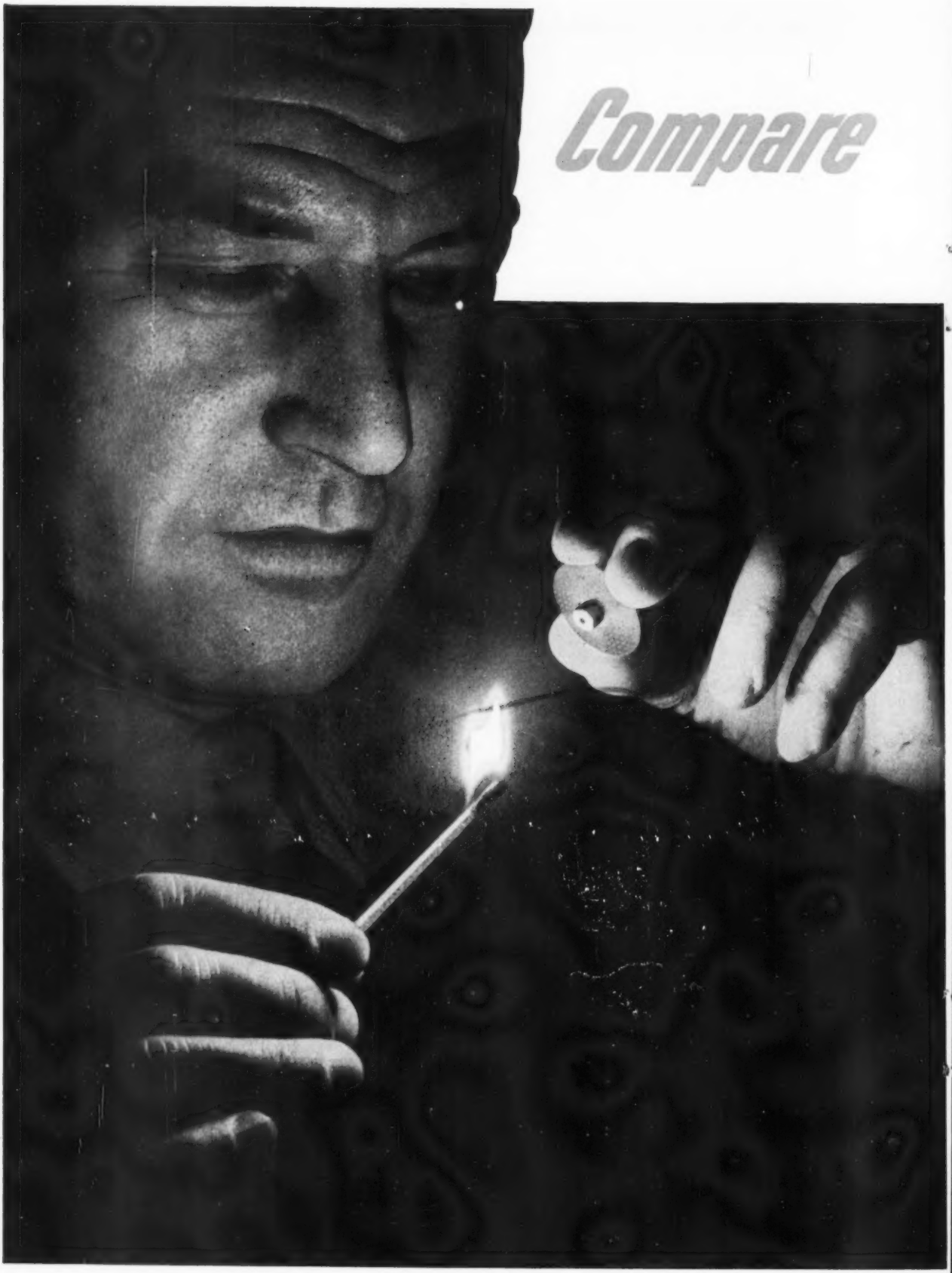
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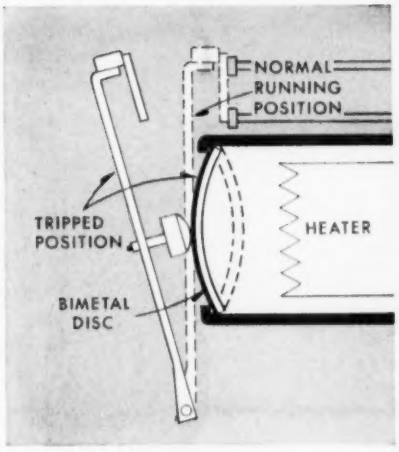
Life-Line starters by this simple demonstration

Proof that Life-Line Starters give you instant, positive motor protection

See this flame test. When heated and placed upon a flat surface, this bi-metal disc will snap up into the air. Here is simple action—demonstrated right before your eyes—powerful, positive action to protect your motors from the destroying heat of dangerous overload.

The bi-metal disc is the nerve center of the overload relay designed into every Westinghouse Life-Line Starter. The disc accurately stands watch over the build-up of motor heat, because a motor can become overloaded. At precisely the right instant, just before a motor may be dangerously overloaded, the disc snaps, as in the flame test. This causes starter contacts to open lightning fast, protecting your valuable motor.

Only Westinghouse Life-Line Starters have the bimetallic, snap-action, disc-type overload relay . . . the most precise motor protective device you can buy. But, just as important, the bi-metal maintains its precision calibration for the life of the starter. It will not fail because it cannot fatigue, age or oxidize. Premature, or "hot" resets can ruin other types of overload relays, such as the solder-pot. Remember—the price of poor protection is smoldering, useless motors, costly motor rewind jobs, other damaged equipment, down time and expensive production pile-ups.



Westinghouse bi-metal principle of overload relay protection, dependable for the full life of the installation.

Proof that Life-Line Starters are tough, maintenance free

Simplicity of design, fewer and more rugged components, only one moving element . . . all spell toughness and long life in Westinghouse Life-Line Starters. Parts that aren't there, can't wear.

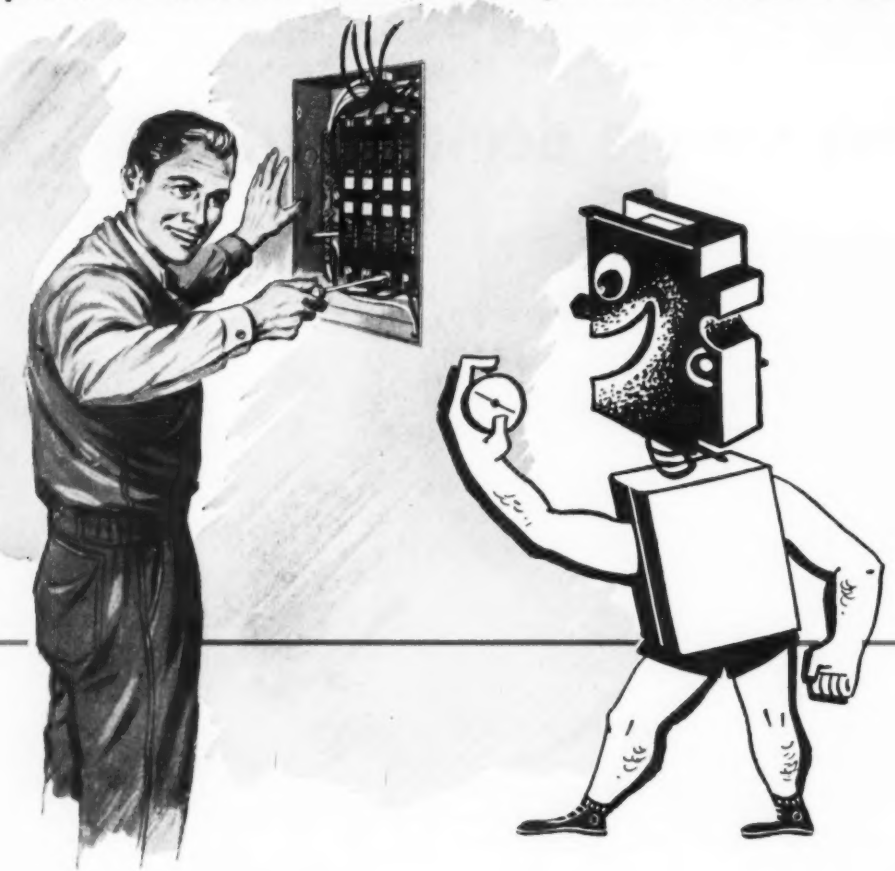
Call your Westinghouse Representative to see the flame test. Or write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-30146



YOU CAN BE SURE... IF IT'S Westinghouse

The contractor thought it was silly...

*till he proved to himself the **Stab-lok**® system costs least to install*



REPORT OF INTERVIEW WITH CONTRACTOR:

Q—We understand you compared the time to install different circuit breakers. What was the result?

A—It wasn't even close! Stab-lok was way out ahead. Stab-lok is so much quicker to install that it cuts labor costs way below other systems.

Q—What are the special features that speed up Stab-lok installation?

A—Well, first, Stab-lok plug-in type individual pole breakers provide the quickest method of securely connecting breakers to busses. Second, Stab-lok's solderless lugs give you today's simplest and fastest form of connection. Then, too, Stab-lok's lug type neutral saves the bother of wire looping... and removable main lugs, in the larger devices, save time when installing main conductors.

* * *

Besides these four features, there are still others that make Stab-lok least costly to install... easily removable interiors... large gutter space... conveniently located knockouts... simplest adjustment to plaster level on flush enclosures.

In addition, Stab-lok is the most modern, complete and flexible circuit protection system on the market. Write for full information, and order Stab-loks from your distributor. Federal Electric Products Company, 50 Paris Street, Newark 5, N. J.

Federal Noark products: Stab-lok Circuit Breakers, Motor Controls, Safety Switches, Service Equipment, Industrial Circuit Breakers, Panelboards, Switchboards, Control Centers, Bus Duct ★ Sales offices in principal cities.

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Here's how

HAZASHEATH

answers your questions about

UNDERGROUND CABLE

Hazasheath Underground Cable, Type RR, carries the approval of the Civil Aeronautics Authority for airport lighting systems.

HOW IS IT MADE?

Hazasheath starts with a corrosion-resistant Hazaloy-coated conductor, then the insulation—Watertite—a rich rubber compound with the ability to retain its superior electrical and mechanical properties after years of continuous immersion in water. Next, in the case of multi-conductor cables, the protective tape and moisture resistant fillers. Finally, the Hazaprene Sheath—extra thick to withstand, chemically and physically, the rigors of underground service. For high voltage applications, this sheath is pressure-vulcanized in continuous metal molds for maximum toughness and resiliency.

HOW DOES IT STAND UP?

Since the development of Hazasheath Underground Cable, millions of feet have gone into service in airports, street lighting systems, mine power circuits—the most demanding types of installations. In addition, Hazard Watertite Insulation, introduced over 25 years ago, has been used in every type of construction work where dampness demands maximum moisture resistance.

WILL IT SAVE ME MONEY?

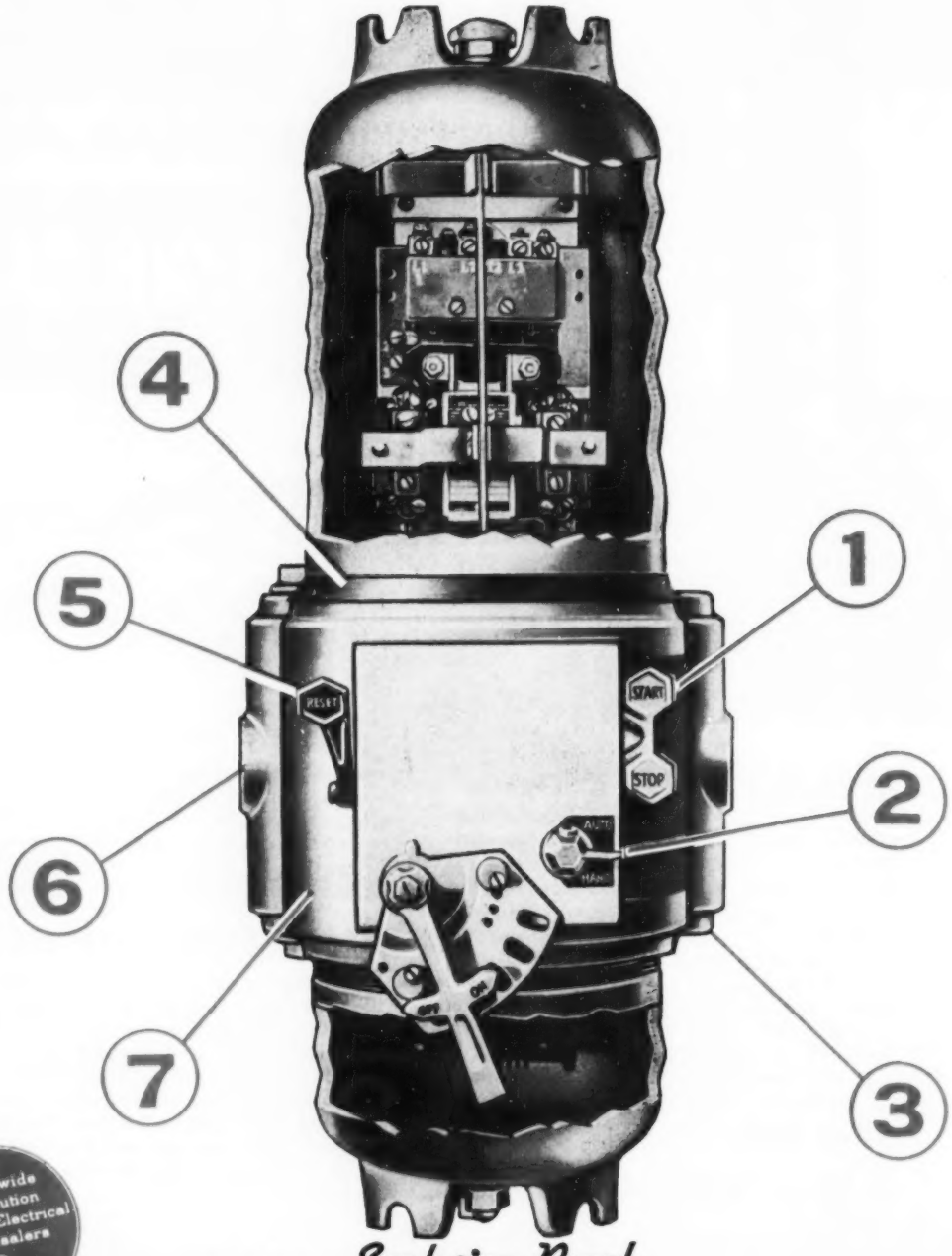
If you're looking for an underground cable that will last for years, that's easy to install and splice, and requires the least amount of maintenance—specify Hazasheath Underground Cable. Long life and dependable performance mean long-term economy...over the years you'll agree that the wise buy's Hazasheath. Let your Hazard representative show you. Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pa.

HAZARD

9431

7 important NEW features

... to the many basic advantages of



Explosion-Proof

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have been added

CROUSE-HINDS Type EPC

motor starter and circuit breaker CONDULET *

You get all of them on the Model M52

Model M52 EPC is the most flexible explosion-proof line starter and circuit breaker enclosure ever produced. The addition of 7 new features to the proven basic advantages of the EPC construction assures the greatest ease of installation and maintenance.

The exclusive basic advantages of the EPC Condulet have made it the world's leading enclosure for housing motor starters, circuit breakers and combinations for use in hazardous locations.

The basic advantages are:

EASY INSTALLATION . . . The use of a strong light-weight aluminum alloy and the unique three-section design makes it practical for an electrician and his helper to install the largest housing without the use of costly lifting equipment. The internal devices can be easily removed for pulling in the wires.

THREADED JOINT CONSTRUCTION . . . All joints are threaded. All operating shafts and bushings are thread-in-thread construction. This insures maximum safety, easy inspection and maintenance, and maximum corrosion protection.

FLEXIBILITY . . . A large number of different enclosures can be assembled from the wide variety of sizes of bodies and covers. They are not only used for circuit breakers and starters but have proven adaptable for many other types of electrical equipment. The body has numerous conduit hubs for flexibility of installation.

COST AND TIME SAVINGS . . . The outstanding advantages of the unique EPC Condulet over conventional explosion-proof enclosures all add up to lower installed cost and lower maintenance cost.

All of these advantages have been available for years.

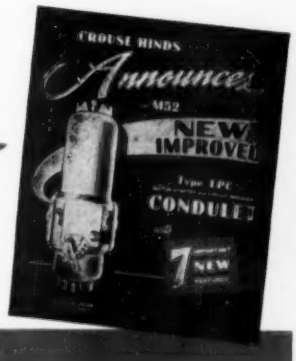
Now Crouse-Hinds offers you 7 new improvements to underline the basic advantages of type EPC Condulets and to save you more dollars and more man-hours than ever before.

1. **Built-in Push button stations** available on line starters and combinations of line starters with circuit breakers — START — STOP, FOR — REV — STOP and HIGH — LOW — STOP stations for regular, reversing, or two-speed starters.
2. **Built-in selector switch** is available on line starters and combinations of line starters with circuit breakers. Normally supplied marked HAND — OFF — AUTO or JOG — RUN — OFF, three-position style. Two-position selector switch or combinations of selector switch with START — STOP station can be supplied.
3. **Back conduit entrance** can be supplied by drilling and tapping the boss in the center of the back . . . in addition to the four regular top and bottom hubs.
4. **Protective Neoprene gasket** is available for the upper cover joint. Where EPC Condulets are exposed to unusually severe weather or corrosive conditions, this gasket provides additional protection.
5. **A new RESET lever with threaded shaft,** rotating within a threaded bushing, provides easier and more positive operation of the reset mechanism.
6. **Horizontal through-feed conduit entrances** are provided by drilling and tapping bosses on the sides of the Condulet body.
7. **Greater ease in wiring** is provided by increased height in the center body section and by universal use of open framework mountings for circuit breakers and starters in the new model M52 EPC Condulets.



Model M52
Type EPC Explosion-Proof
Condulet in 7, 9, and 11-inch
body sizes

Send for YOUR copy of Bulletin 2634 →



*CONDULET is a coined word registered in the U. S. Patent Office. It designates a product made only by the Crouse-Hinds Company.

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Syracuse 1, N. Y.

OFFICES: Albuquerque – Birmingham – Boston – Buffalo – Chicago – Cincinnati – Cleveland – Dallas – Denver – Detroit – Houston – Indianapolis – Kansas City – Los Angeles – Milwaukee – Minneapolis – New York – Philadelphia – Pittsburgh – Portland, Ore. – San Francisco – Seattle – St. Louis – Tulsa – Washington. RESIDENT REPRESENTATIVES: Albany – Atlanta – Baltimore – Charlotte – New Orleans – Richmond, Va. Crouse-Hinds Company of Canada, Ltd., Toronto, Ont.

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YEARS OF ELECTRICAL PROGRESS

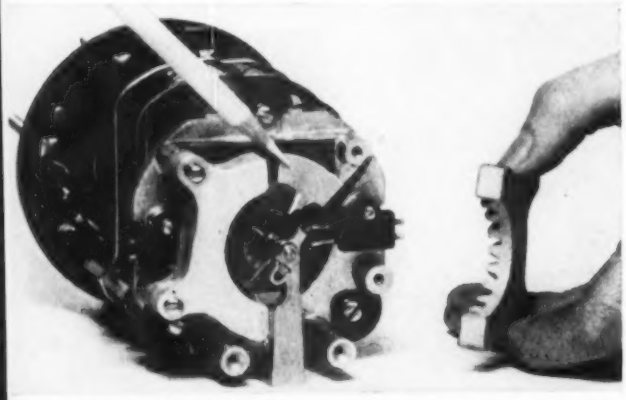


OPERATOR TAKES READINGS QUICKLY AND EASILY WITH GENERAL ELECTRIC TYPE AB-18 SHADOW-PROOF SWITCHBOARD INSTRUMENTS

G-E Long-scale Instruments Provide Improved Repeatability, Sturdiness

Now you can be assured of dependable, accurate, and consistent readings with G-E switchboard instruments. These small-sized instruments are for general service on both large and small equipment, such as control stations, testing devices, and other installations where space is limited.

REPEATABILITY is assured because of a superior design which includes a unique system of magnetic damping that cuts armature weight and reduces friction.



NARROW VANE DAMPING SYSTEM cuts the armature weight, improves instrument accuracy, and reduces pivot wear.

STURDINESS is obtained from strong cast-aluminum frames and aluminum shafts. The expansion rates being the same, pivots are prevented from coming loose or jamming. The one-piece, all metal scale plate withstands abnormal humidity and temperature conditions.

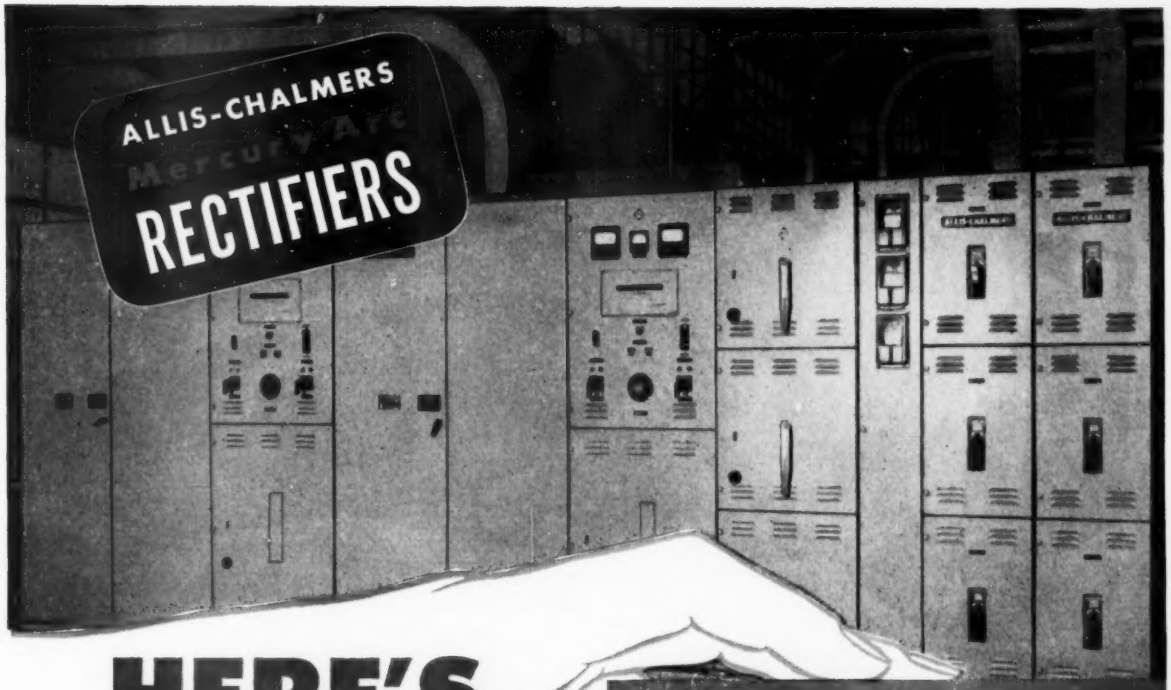
SHADOW-PROOF COVER assures you of easy readability. Cover overhang and overhead-lighting shadows are eliminated because the dial is set flush with the front of the case. A protruding convex-glass cover gives all-around illumination which assures legible figures.

COMPLETE INSTRUMENT LINE is available. You can get G-E shadow-proof instruments in both 4¼-inch (Type AB-18) and 8¾-inch (Type AB-16) sizes. Available as ammeters, voltmeters, and wattmeters; frequency and power-factor meters; temperature indicators and synchroscopes.

FOR MORE INFORMATION write or call your nearest G-E Apparatus Sales Office. Write for Bulletin GEC-218, General Electric Co., Section 602-252, Schenectady 5, N. Y.

You can put your confidence in—

GENERAL ELECTRIC

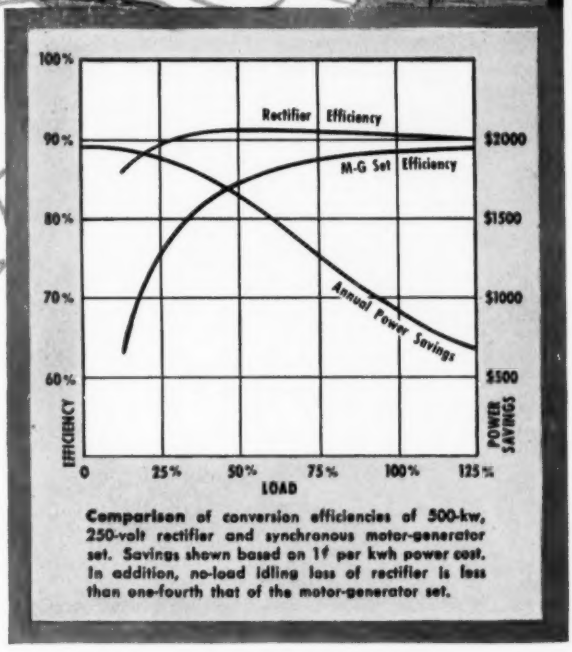


HERE'S PROOF of Low-Loss Conversion

TO OBTAIN economical dc power for arc furnace and blooming mill auxiliaries, West Virginia Steel & Manufacturing Company recently installed mercury arc rectifiers.

The factory-packaged Allis-Chalmers unit includes duplicate 500-kw, 250-volt rectifiers, with tube, breaker, control, and metering compartments, plus dc and ac plant feeder breakers. Since transformers could be installed outdoors, the assembly departs from the usual double-ended arrangement.

Rectifiers were chosen for their high conversion efficiencies *plus* simplified foundation needs, easy installation and minimum maintenance. And Allis-Chalmers units incorporate continuous excitation, grid phase control, internal cooling and enameled anode seals.



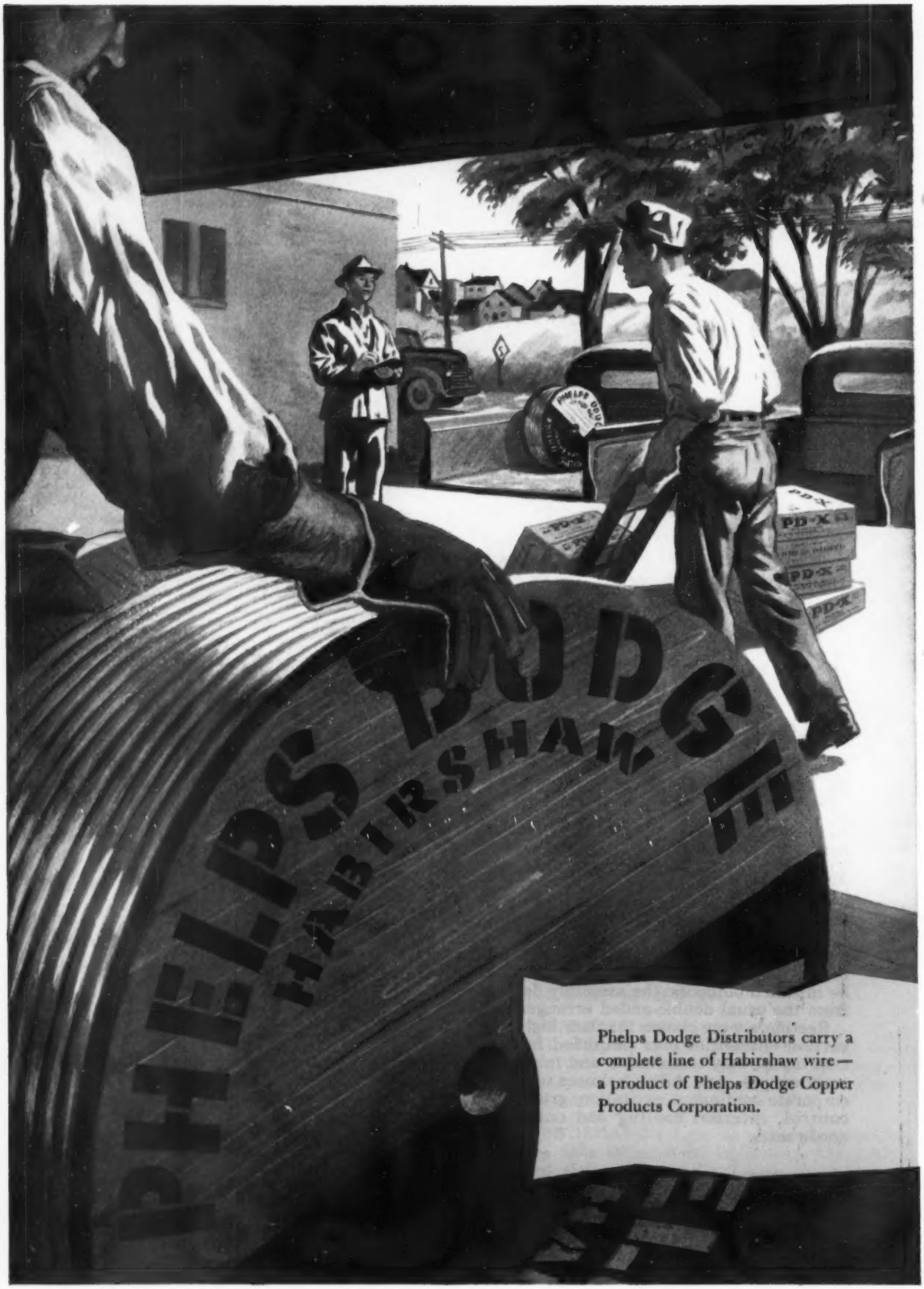
Comparison of conversion efficiencies of 500-kw, 250-volt rectifier and synchronous motor-generator set. Savings shown based on 1¢ per kwh power cost. In addition, no-load idling loss of rectifier is less than one-fourth that of the motor-generator set.

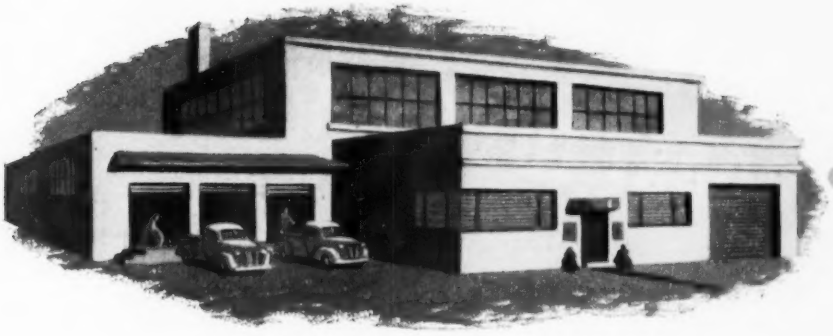
Use A-C's Engineering Experience

By calling your A-C representative, you can put A-C's quarter century of rectifier application experience to work on your power conversion problems. Allis-Chalmers, Milwaukee 1, Wisconsin. A-3989

ALLIS-CHALMERS

Our Engineers Introduced Mercury Arc Rectifiers to U. S. Industry


PHELPS DODGE
HABIRSHAW
PD-X
PD-X
PD-X
PD-X
Phelps Dodge Distributors carry a complete line of Habirshaw wire—a product of Phelps Dodge Copper Products Corporation.



SEE YOUR PHELPS DODGE DISTRIBUTOR FOR

QUALITY and SERVICE

THAT SIMPLIFY YOUR JOB!

It's easier to maintain a reputation for the highest quality materials, the most dependable job performance, when you rely on a Phelps Dodge Distributor for your wire requirements.

Your distributor's personal background of experience is backed by Phelps Dodge's engineering "know-how" which is available when needed.

PHELPS DODGE COPPER PRODUCTS CORPORATION

WIRE BY PHELPS DODGE MEANS WIRED FOR LIFE!



For many years Contractors from Coast to Coast have used Briegel All Steel Indenter Fittings. U. L. approved as concretetight and for general use, B-M Indenter Fittings are faster, easier to use and neater in appearance.

Installation is simple and less expensive. Two quick squeezes sets them forever. Try B-M Indenter Fittings and get more profits from each job!



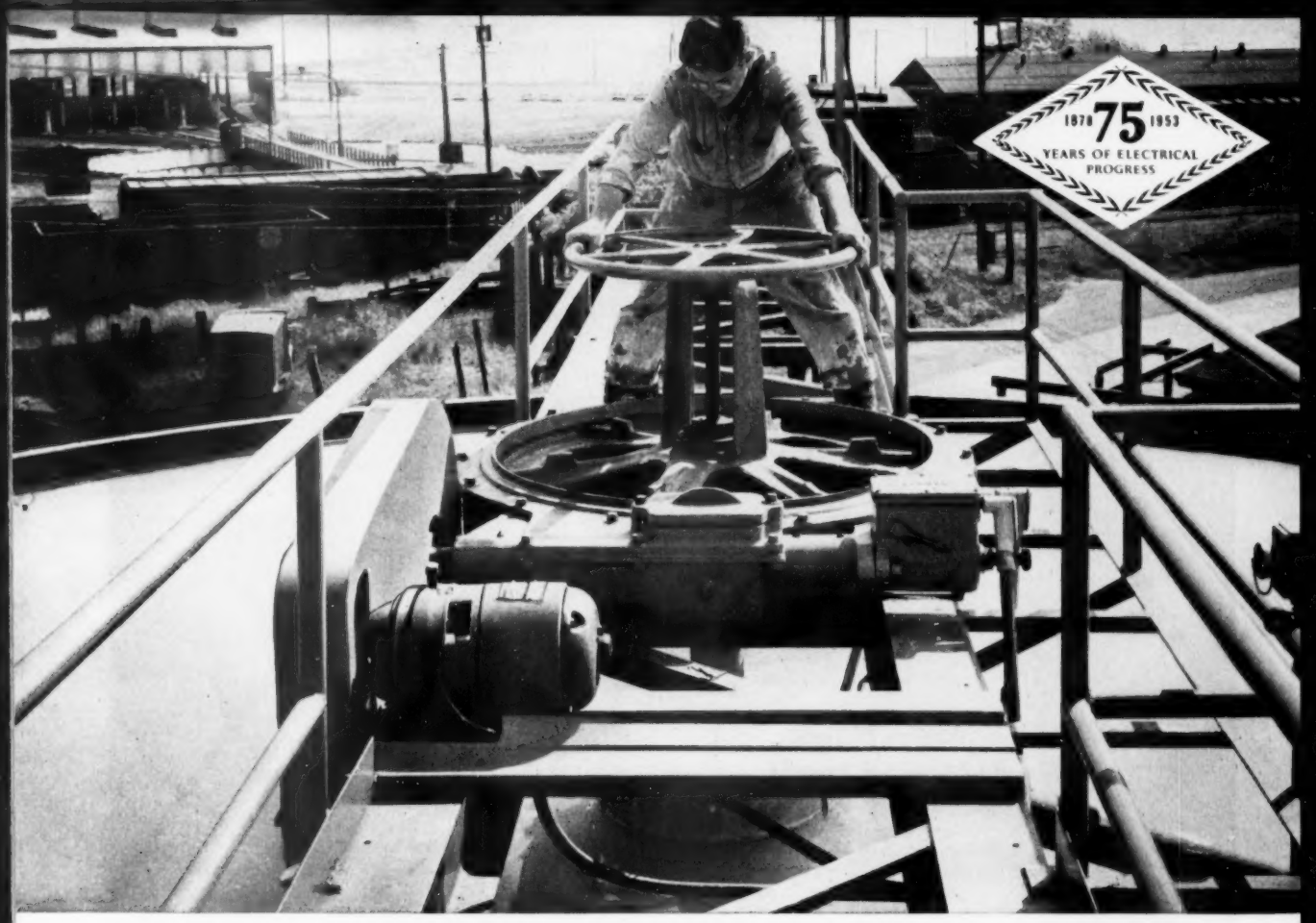
Cross Section Showing Indentations.

BRIEGEL METHOD TOOL CO.

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Distributed by

The M. B. Austin Co., Northbrook, Ill.; Clayton Mark & Co., Evanston, Ill.; Nikoh Tube Co., 5000 South Whipple St., Chicago, Ill.; Clifton Conduit Co., Jersey City, N. J.; The Steeldect Co., Youngstown, Ohio; Columbia Cable & Electric Corp., 255 Chestnut St., Brooklyn, N. Y.; Pittsburgh Standard Conduit Co., Pittsburgh, Penn.; Wagner Malleable Products Co., Decatur, Ill.; J. R. Richards Co., Carnegie, Penn.; Kondu Mfg. Co., Ltd., Preston, Ont.



THIS G-E GEAR-MOTOR WAS PICKED TO RUN A SLUDGE ACCUMULATOR 24 HOURS A DAY AND 7 DAYS A WEEK BECAUSE . . .

New G-E Gear-motor Reduces "Down-time"

Easy stator removal, use of Tri-Clad* motors, cuts maintenance costs and time more than 50%.

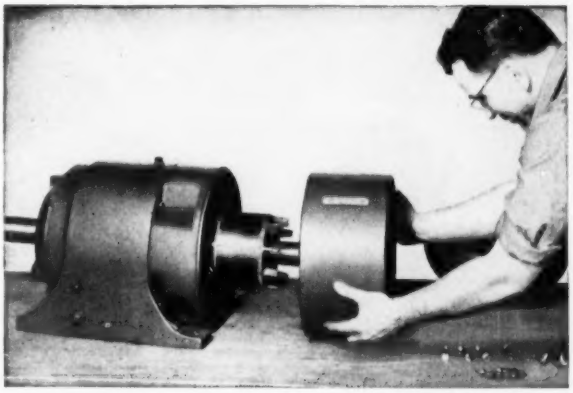
G-E Gear-motors are single units—compact and efficient—the most economical method of gear reduction for low-speed drives. This year, they have been redesigned to offer you additional operating economy.

EASY STATOR REMOVAL is now possible without disturbing the gear-train in any way. Also, any standard G-E motor—with or without feet—may be used as a stator replacement. These advantages mean a reduction of non-productive "down-time"—and substantial cost savings!

TRI-CLAD MOTORS are now an integral part of every G-E Gear-motor. These are the same motors which have gained such a wide acceptance throughout industry—the motors which assure you of extra reliability—triple protection against physical damage, electrical breakdown, and operating wear and tear.

A new stocking plan keeps most popular ratings available on a 1-week basis. You can order your gear-motor from your nearest G-E Apparatus Sales Office or your Authorized G-E Agent or Distributor. General Electric Company, Schenectady 5, N. Y. 755-10

Registered Trade-mark of General Electric Company



Rabbet fit between stator and gear-motor frame assures positive realignment. Note that stator removal is simply a matter of removing a few bolts—can be done without disturbing gear-train.

GENERAL ELECTRIC


20" TWO-SPEED
ADJUSTABLE
MOBILE FAN
Designed for residential, commercial and industrial use
NEW
. . . and significant addition
to the respected Signal Line
Catalog sent upon request
Signal
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Compare these advantages of U. S. ROYALASTIC Tape!



★U.S. Royalastic Vinyl does two jobs in one — it provides as much as 200% more dielectric protection and 50 to 100% more mechanical protection.

★Adheres perfectly and permanently to all kinds of shapes, yet it can be stripped cleanly and neatly.

★Extra rugged to withstand abrasion.

★Resists acids, alkalies, oils, water, temperature changes and weather conditions.

★Saves time and space in hard-to-reach places.

United States Rubber Company is now a single source for every electrical tape. In addition to U.S. Royalastic, there is U.S. Holdtite Friction Tape, and U.S. Holdtite Rubber Tape. For best results use "U.S."

PRODUCT OF U.S. RUBBER SERVING THROUGH SCIENCE

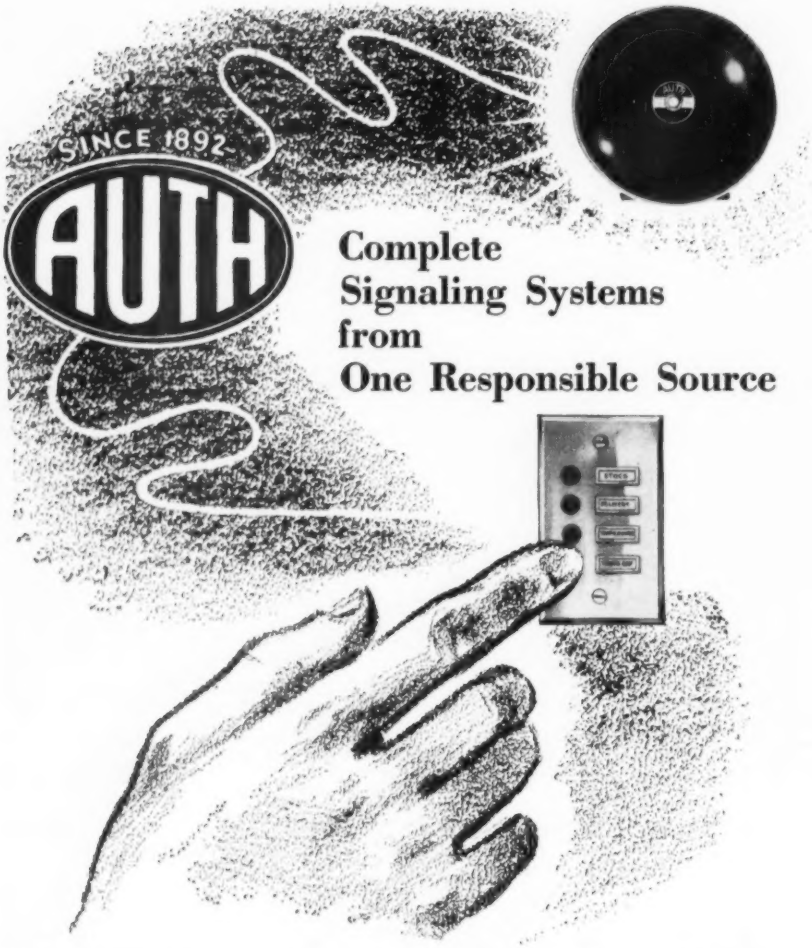
UNITED STATES RUBBER COMPANY

MECHANICAL GOODS DIVISION • ROCKEFELLER CENTER, NEW YORK 20, N. Y.

SINCE 1892

AUTH

Complete Signaling Systems from One Responsible Source



Electrical signaling systems usually consist of a number of different components which, when electrically connected, form a complete operating system. For example, Clock and Program Bell Systems for schools often comprise a program time instrument, a central clock-resetting device, a manually-operated cross-connecting bell control board, indoor and outdoor audible signals such as bells, buzzers and horns, and dual-motored clocks of various styles. The Fire Alarm and Intercommunicating Telephone Systems for schools are just as diverse in their components.

Likewise, the signaling systems which comprise the nerve centers of hospitals, housing projects, industrial plants and commercial establishments all consist of many different components electrically connected to perform their necessary, and often vital, functions.

The importance of securing all components of a system from one responsible source is obvious. To the architect, engineer, distributor and electrical contractor it means the ability to specify, purchase and install with the utmost confidence and with a minimum of effort and expense. To the owner it means standardization of equipment with consequent ease of maintenance.

The Auth Electric Company has been a responsible manufacturer of signaling systems for many years. It supplies all the necessary components for the installation of complete systems; also, all required specification and engineering data. Your nearest Auth office will be glad to give you information on Auth Signaling Systems, or you may write directly to the **Auth Electric Company, Inc., 34-20 45th St., Long Island City 1, New York.**



Complete Systems for Hospitals
Nurse's Call, Vokalcall (Audio-Visual), Doctors' In & Out, Doctors' Paging, Fire Alarm, Synchronous Clock, Intercom Telephone, and Return Call (For Nurses' Home). Also night lights.

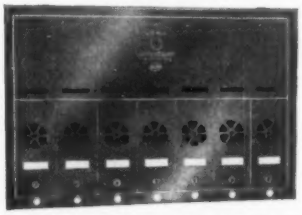


Complete Systems for Schools
Clock and Program Bell, Fire Alarm, Intercom Telephone, and Miscellaneous.



Complete Systems for Industry
Bell, Intercom Telephone, Fire Alarm, Annunciator, and Synchronous Clock.





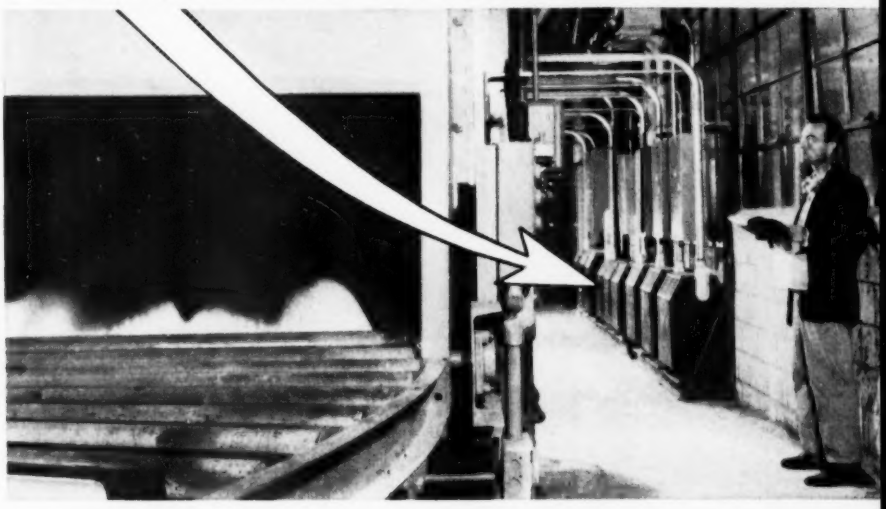
Complete Systems for Housing
Apartment Telephone and Flush Bell. Also Apartment Mail Boxes and Non-Electric Door Chimes.

SINCE 1892

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FOREMOST IN THE DESIGN AND MANUFACTURE OF ELECTRICAL SIGNALING, COMMUNICATION, TIME, AND PROTECTIVE EQUIPMENT FOR SCHOOLS, HOSPITALS, HOUSING, OFFICES, SHIPS, AND INDUSTRY.

FORGING INDUSTRY application of G-E Dry-Type Transformers is shown below in Fremont Ohio plant of the Bingham-Herbrand Corporation. G-E Type D's, installed at load, reduce voltage for heating elements of G-E Roller Hearth Electric Furnace.



G-E Dry-Type Transformers cut industry's power losses

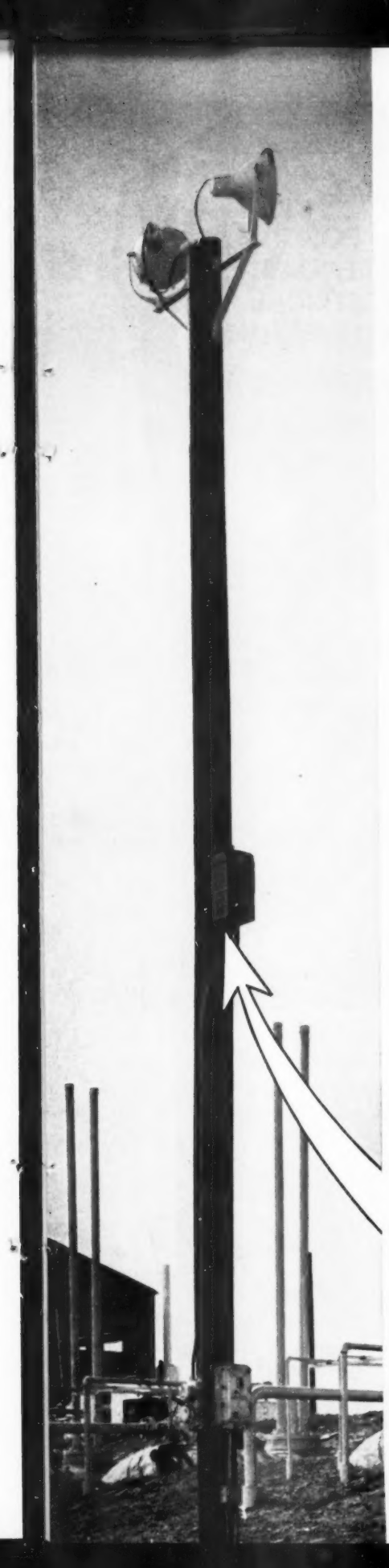
Throughout industry, wherever voltage changes are required, G-E Dry-Type Transformers, installed right at the load, do the job efficiently and economically. By eliminating long runs of costly secondary feeders, they reduce wiring costs, cut line losses, help stretch industry's power dollars.

Easy to install, G-E Dry-Type Transformers can be mounted out of the way on columns, wall brackets or platforms. Solderless connectors on many of the higher ratings do away with splicing, soldering and taping. Quiet in operation, they have efficient cooling and require virtually no inspection.

Find out how G-E Dry-Type Transformers can cut *your* power losses. Call your nearest authorized G-E Distributor today. Or write for Bulletin GEC-868A, Section 411-107, General Electric Co., Schenectady 5, N. Y.

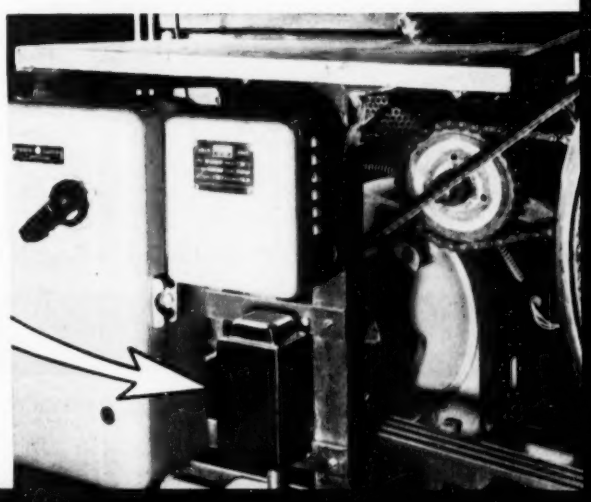
You can put your confidence in—

GENERAL ELECTRIC



UTILITIES. Type M Transformers serve 120 and 230 volt loads either indoors or out. At left, pole-mounted Type M steps down voltage for outdoor lighting circuit at Washington Gas Light Co. plant, Rockville, Md.

PRINTING press motor and controls are served efficiently with Type M mounted on the press, at Lord Baltimore Press, Baltimore, Md. Indoor loads can use Type M's (.25 thru 15 kva) or Type D's (25 kva and above).





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for POSITIVE, DEPENDABLE ELECTRICAL CONNECTIONS

IT'S THE NEW
P&S
Turnlok
LINE
Receptacles . . . Caps
Connectors

"A Turn of the Cap and It's Locked"

USE P&S TURNLOK — wherever the uninterrupted flow of electrical current means TIME SAVED — MONEY SAVED — INCREASED SAFETY. Designed for quick, easy wiring — with added safety features — P&S Turnlok will give years of trouble-free service.

YOURS FOR THE ASKING

The new 8-page descriptive manual with complete illustrations, dimensional and catalog information. Just drop us a line on your letterhead.



Write Dept. M

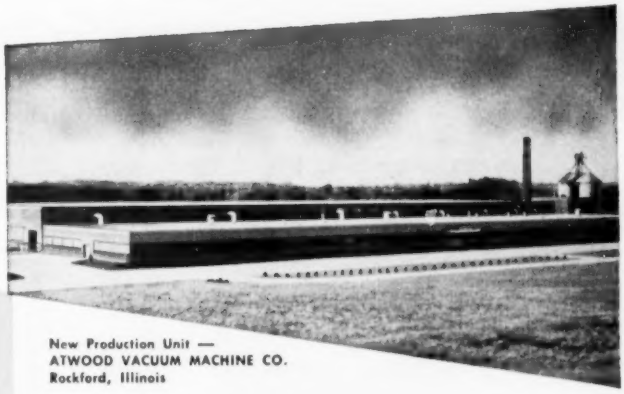
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For the Industrial Plant of Today and Tomorrow

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New Production Unit —
ATWOOD VACUUM MACHINE CO.
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SHUTLBRAK SWITCHBOARD



QP QUICKLAG PANELBOARD

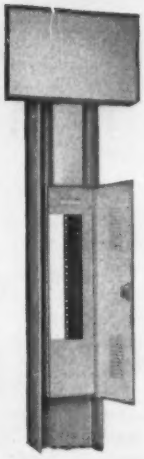


POWERPLUGIN (Midget Size)

POWERPLUGIN



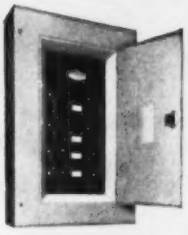
SCA ENCLOSED SHUTLBRAK SWITCH



COLUMN TYPE PANELBOARD



DUSTITE PANELBOARD



PULFUZSWITCH PANELBOARD

Ⓕ PRODUCTS for the control and distribution of power and light have been specifically geared to the needs of the factory of today and tomorrow.

Besides being safe, efficient, dependable, economical, long-lasting and trouble-free, all Ⓕ switchboards, panelboards, busduct and other similar equipment used in modern industry, have been designed to provide the electrical capacity needed for today and allow for future expansion by the simple addition of necessary units.

If any of your customers are planning a new plant, or modernization and improvement of an existing factory — regardless of size — urge them to install Ⓕ products — the equipment with a future.

For additional information consult your nearest Ⓕ representative, listed in Sweet's. He will be glad to be of any help he can.

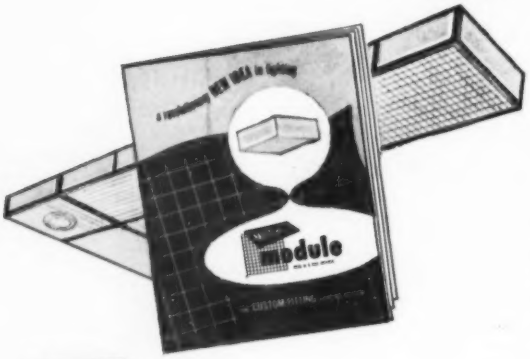
Frank Adam Electric Co.

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ST. LOUIS 3, MISSOURI

Makers of: BUSDUCT • PANELBOARDS • SWITCHBOARDS • SERVICE EQUIPMENT • SAFETY SWITCHES • LOAD CENTERS • QUIKHETER

easiest to specify, easiest to install, easiest to sell

America's most **complete** Quality Lighting Line



MITCHELL **module** CUSTOM-FITTING LIGHTING

REG. U. S. PAT. OFFICE

The revolutionary lighting system for commercial interiors. Forms unlimited patterns—delivers 20% MORE LIGHT—installs quickly and economically—offers enduring beauty. Four basic "building blocks of light" CUSTOM-FIT any commercial interior at no more than the cost of ordinary fixtures. For full details, ask for **Catalogs No. 360 and No. 370.**



MITCHELL

COMMERCIAL FLUORESCENT LIGHTING

MITCHELL offers 70 superb Commercial Luminaires to meet the requirements of every conceivable installation: stores, offices, schools, institutions. You can specify MITCHELL Luminaires with confidence—they're tops for quality, time-saving installation, low-cost maintenance and lighting efficiency. **Ask for Catalog No. 433.**

MITCHELL

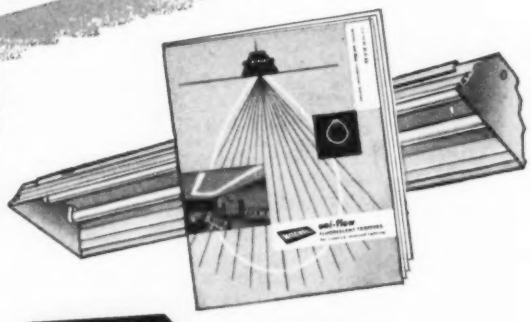
EVERYTHING IN LIGHTING FROM ONE DEPENDABLE SOURCE



MITCHELL **DYNALITE**

Job-rated Lighting for Industry

You'll find it easy to specify for any industrial application when you choose from the complete line of 82 DYNALITE units. Available in all lengths and lamp types, with choice of reflectors and shielding. There's a DYNALITE that's PRODUCTION-RIGHT for every job. Full details in **Catalog No. 438.**



MITCHELL ***uni-flow***

Fluorescent Recessed Lighting

Here's the latest and finest achievement in recessed lighting: 6 different troffer lengths (shallow or deep); 12 types of shielding; 7 types of lamps; choice of reflectors—PLUS exclusive ONE-MAN installation feature that cuts installing time by 50%! The complete facts are in **Catalog No. 605.**

It's easy to specify, easy to sell from MITCHELL'S "tell-all" Catalogs covering Everything in Lighting. Write for them today.

MITCHELL MANUFACTURING COMPANY
2525 N. Clybourn Ave., Chicago 14, Illinois
In Canada: Mitchell Mfg. Co., Ltd., 14 Waterman Ave., Toronto

ADDRESS DEPT. 2-D

THIS COMPLETE LINE MEETS EVERY NEED FOR PUSHBUTTONS





STANDARD DUTY



HEAVY DUTY

Name your pushbutton requirement—there's a Square D unit to do the job, exactly. Three complete lines . . . standard duty, heavy duty, and oil-tight heavy duty . . . each providing a wide range of operators, stations, and circuit combinations.



OIL-TIGHT HEAVY DUTY

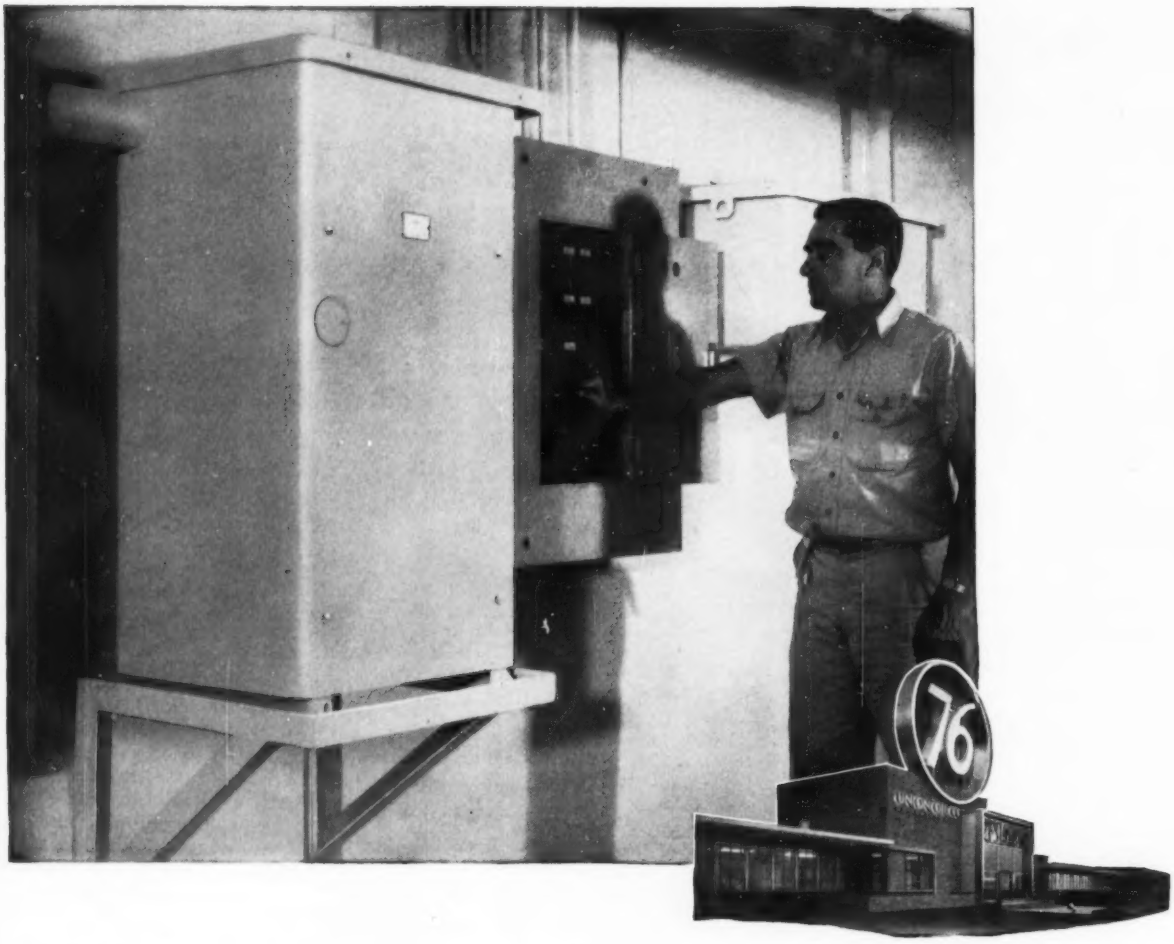
Available in 1 to 16 unit sizes. 6-9-12-16 unit stations have hinged covers for easier wiring

Write for Pushbutton Bulletins which give complete details. Address Square D Company, 4041 N. Richards Street, Milwaukee 12, Wisconsin.

ASK YOUR ELECTRICAL DISTRIBUTOR FOR SQUARE D PRODUCTS

SQUARE D COMPANY

1903 · 50 YEARS OF DESIGN LEADERSHIP · 1953



"Off-The-Shelf" transformers meet exacting laboratory standards

Two conditions—the high level of safety required in their experimental work, and dependably constant voltages—influenced the choice of transformers when Union Oil Company constructed their outstanding new Research Center.

Westinghouse Dry-Type Transformers (now available in distributor stocks everywhere) filled both requirements.

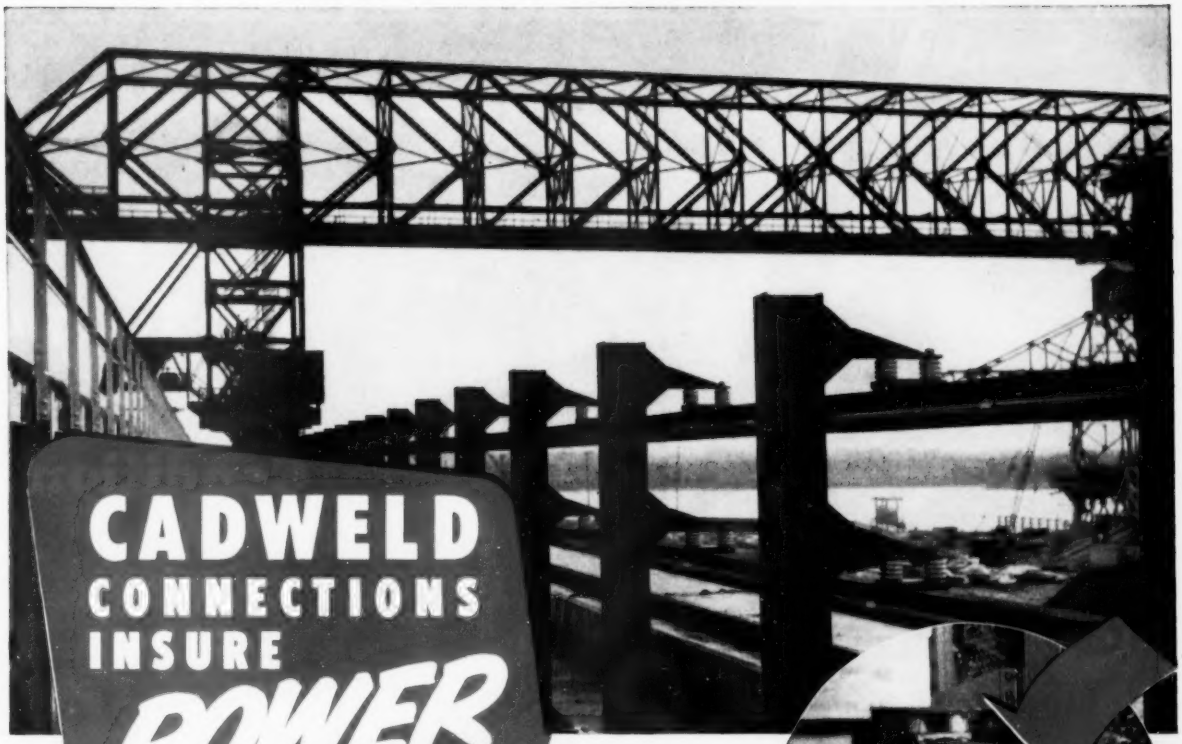
The larger of the two transformers shown above is a 75-kva unit. It is located in the basement at the center of the load area, directly under the laboratory it serves. The 25-kva transformer in the background handles the lighting load.

Air cooled, containing no combustible materials, these transformers could be located safely inside the building. Because their small size and light weight made installation less of a problem, they were easily mounted at selected load points . . . thus eliminating long secondary runs that would cause line losses and undesirable voltage variations.

You can meet new or changing load problems effectively and economically with Westinghouse Dry-Type Transformers. Savings include lower maintenance, operating and power costs. For further information, contact your local Westinghouse representative or distributor. Or write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-70665

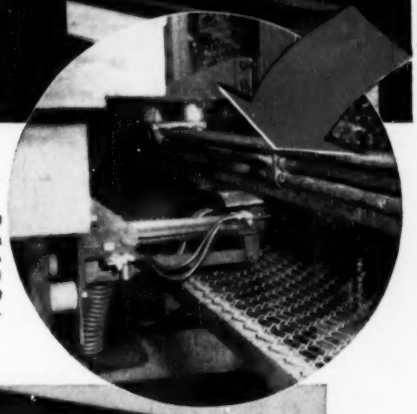
YOU CAN BE SURE...IF IT'S

Westinghouse



CADWELD CONNECTIONS INSURE POWER

WHEN AND WHERE YOU NEED IT!



● TWO—1000 MCM power cables "CADWELDED" to an inverted 110# feeder rail. Contact shoe riding underside of rail.

NO VOLTAGE DROP when booster cables are "CADWELDED" to feeder rails on ore bridges and traveling cranes.

CONSTRUCTION AND MAINTENANCE COSTS ARE SUBSTANTIALLY REDUCED by the use of "CADWELD" as connections are made in a matter of minutes with lightweight portable equipment.

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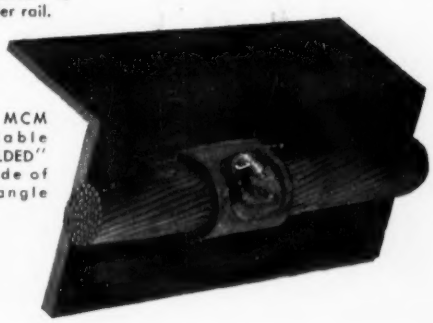


● 1000 MCM power cable "CADWELDED" to 40# feeder rail.

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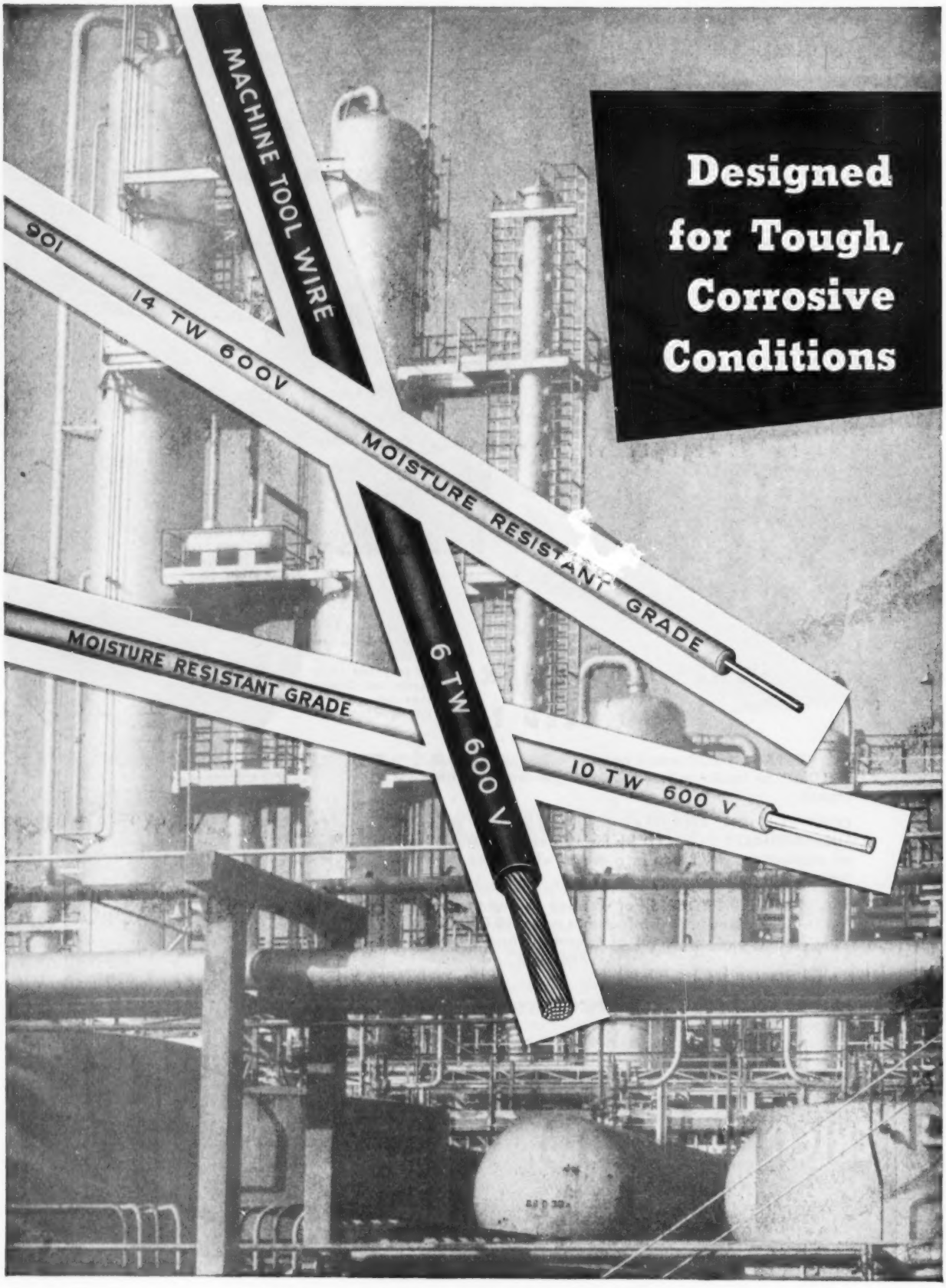


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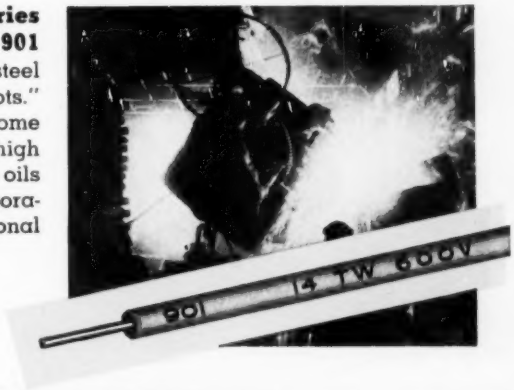
This rugged, polyvinyl chloride type insulation has proven its ability to resist acids, moisture, abrasions, corrosive fumes, flame, oils and cutting solutions. Colors remain permanently clear for quick, easy circuit identification.

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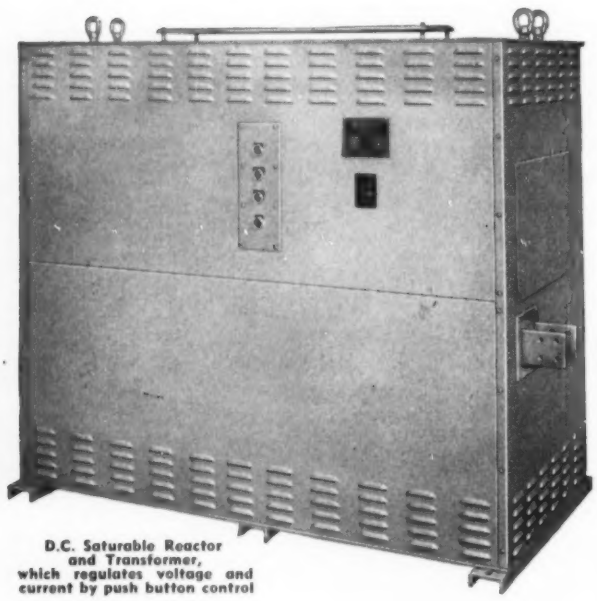
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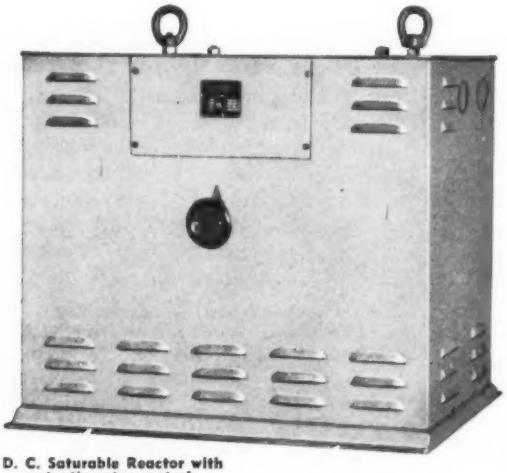
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FOR REAL HELP TO SMALL BUSINESS

It is ironic that one of the first jobs of the Eisenhower administration, so widely, and erroneously, tagged as a "big business" administration, must be to go to the relief of small business. This is necessary because the preceding administration, while continually proclaiming its tender regard for small business, actually impaired gravely the ability of small business to carry on successfully. This it did in the necessary haste of devising an emergency tax program to finance rearmament and the Korean War. Now the new administration must revise this tax structure to give small business a chance to make its key contribution to an expanding American economy.

How Taxes Hurt Small Business

Since the outbreak of the Korean War, small business has been handicapped by two principal features of the emergency tax program:

1) Many small firms are unable to retain enough of their earnings to provide for expansion because these earnings are drastically limited by the excess profits tax.

2) Small companies have received a very small share of the tax concessions allowed by the federal government to encourage construction of defense facilities.

A small business that succeeds and hence grows is particularly hard hit by the excess profits tax. That tax, of course, applies to corporations having a net income of more than $25,000 per year. It results in taking up to 82 cents on every dollar of profit that the company earns above what is called an "excess profits credit." For most small companies the credit depends on what was earned in 1946-49. This creates an element of gamble and discrimination in determining the amount of tax to be paid. Time has proved that it is impossible to select a base period for the tax that is fair to all companies. A young company starting in 1946-49 is peculiarly vulnerable, as its earnings in that period were necessarily low. Even on modest earnings today, it would pay a high excess profits tax.

It is true that Congress wrote into the excess profits tax law provisions to lessen the impact of the tax on growing companies. However, none of these provisions in practice has given much relief to small business.

"Relief" Provisions Give Little Relief

Small firms rely almost entirely on retained earnings to provide funds for improving their plants and equipment. They get very little help from the provisions (1) that no more than 70 per cent of total profits can be taxed away, (2) that additional earnings are allowed on an increase of invested capital or (3) that growing companies are allowed a

rate of return on capital equal to the industry average.

Most large firms can obtain additional funds in the securities market. But small firms find it difficult to increase their capital by selling securities, since investors generally prefer the stocks or bonds of nationally known and seasoned companies. Few small companies, therefore, can reduce their tax burdens by increasing their invested capital, and few can meet their needs for equity capital if their rates of profit are no higher than those of the leading companies which generally set the average profit.

Small business has been equally at a disadvantage in the matter of accelerated depreciation for tax purposes. The government has encouraged a great expansion of our industrial plant, despite the very high rate of taxation on corporate earnings, by granting certificates of accelerated amortization on new plants built to support the defense program. These certificates allow business to charge off the cost of defense plants at a rapid rate. This decreases the earnings that are subject to taxes, and so increases the part of the earnings that may be retained in the business.

Growth is Stifled

But most of these tax concessions have been made to large firms especially equipped to handle the complex problems of defense production. Of the $12 billion of new facilities so far approved for fast amortization, only 11 per cent are for companies with less than 500 employees, although the share of such companies in the normal civilian business is about 30 per cent. In only 2 of 12 industries studied by the Small Defense Plants Administration were small firms receiving what was estimated to be a fair share of the total tax amortization awarded.

Because they are unable either to retain enough earnings after taxes or to step up their depreciation allowances, most small firms are unable to keep up in the race to expand and modernize plant capacity. The Small Defense Plants Administrator, in his report to Congress, emphasized that small companies have been unable to do their full part in the defense program for lack of capital.

The Council of State Chambers of Commerce recently published an eight-state survey showing widespread cutbacks of plans for new plants by small and medium-sized companies. According to this report, "high federal taxes enacted since the beginning of the Korean War appear to be placing an effective brake on the rate of industrial expansion in all the states surveyed and probably in the 48 states generally . . . It is principally the small and medium-sized companies whose growth is being stifled."

Some Ways to Help

The first step to relieve small companies should be to free them from the excess profits tax. The nation as a whole would be far better off if the excess profits tax were allowed to die as scheduled on June 30, since the tax promotes waste as it stifles incentives. It is quite possible, however, that the politics of tax reduction, as opposed to the economics, will prevent the elimination of the tax during 1953.

If the tax is extended, provision should be made for a much broader exemption to smaller corporations. If net income up to $100,000 a year, which in these days still constitutes small business, were exempted from the tax, the loss of revenue to the government would be about $175 million. This relatively small amount could easily be offset by an increase in employment and incomes if small business is freed from its financial strait jacket and allowed to expand. Careful attention should be given also to the possibilities of allowing a higher rate of return on the first $1 million of capital (roughly the amount it takes to provide 100 jobs) and of making special accelerated depreciation allowances to smaller firms. This is a matter so important that we shall return to it in a future editorial.

Relief for small business—relief from a financial paralysis that has kept it from playing its dynamic part as a growth element in our economy—would do much to give the lie to the notion that the Eisenhower administration is a "big business" operation. Much more important, it would be a long stride toward releasing the dynamic energies of many small businesses and businessmen to forward a continuing and expanding prosperity.

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Corrosion won't hurt this TRI CLAD motor's cast-iron frame

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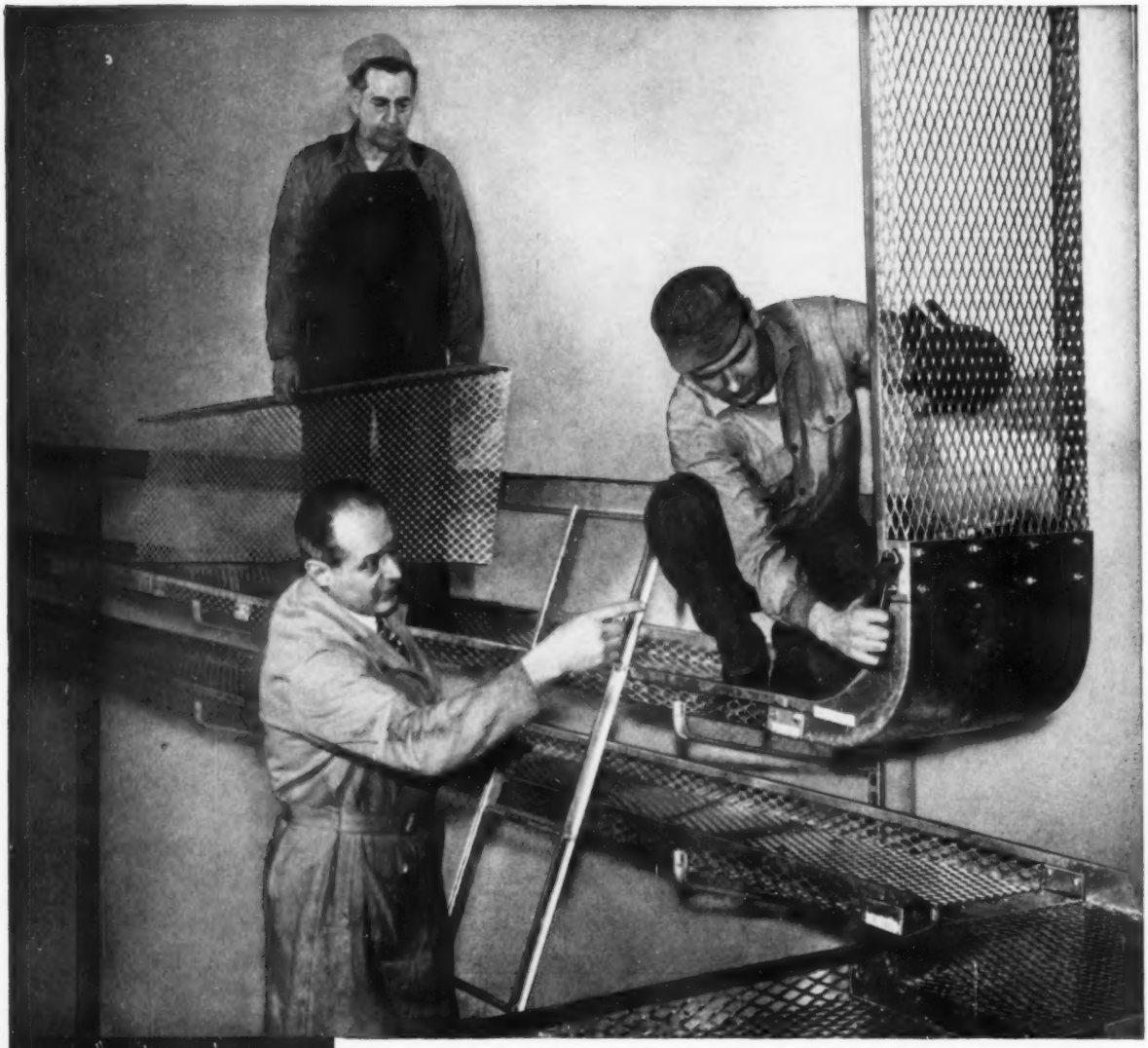
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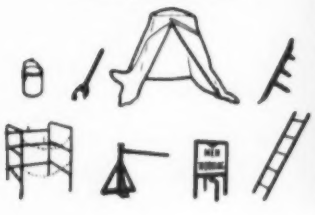
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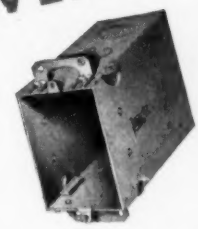
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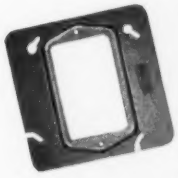
The Raco line of switch and outlet boxes is much more than an unusually complete line, designed to meet every need and preference in its field. Almost every item (like the four examples shown) has some special feature, Raco engineered to make that unit just a little better than run-of-the-mill merchandise. That's why Raco is the line to stay with.



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"De-ion®" arc quenching used on Life-Linestarters has proved the most efficient method of increasing contact life and interrupting capacity. Pictured on the left is the exclusive Westinghouse "De-ion" Quencher at work. In 1/120 of a second, arcs are confined, divided, extinguished—a *basic* to long contact life and equipment protection. It's the last word in arc quenching. Combined with silver contacts, this "De-ion" principle eliminates the need for constant contact maintenance. Contacts *never need* filing.

Pre-lubricated bearings on Life-Line motors have introduced new freedom from motor maintenance. You eliminate bearing failures due to overlubrication, under lubrication, and from entrance of dirt into bearings. Result is reduction of motor down time. Certainly, the way to grease a modern motor is *don't*. Results of over half a million Life-Line motors serving every phase of industry show motor failures cut in half!

It's this kind of advanced features that puts Life-Line motors and Life-Linestarters years ahead of conventional equipment. Get all the reasons why. Ask your Westinghouse representative for full details, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-21693-A

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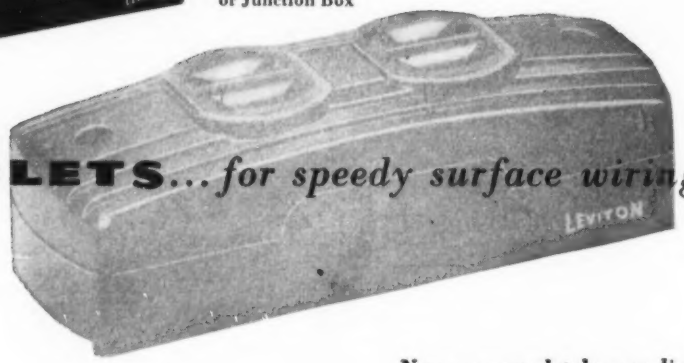


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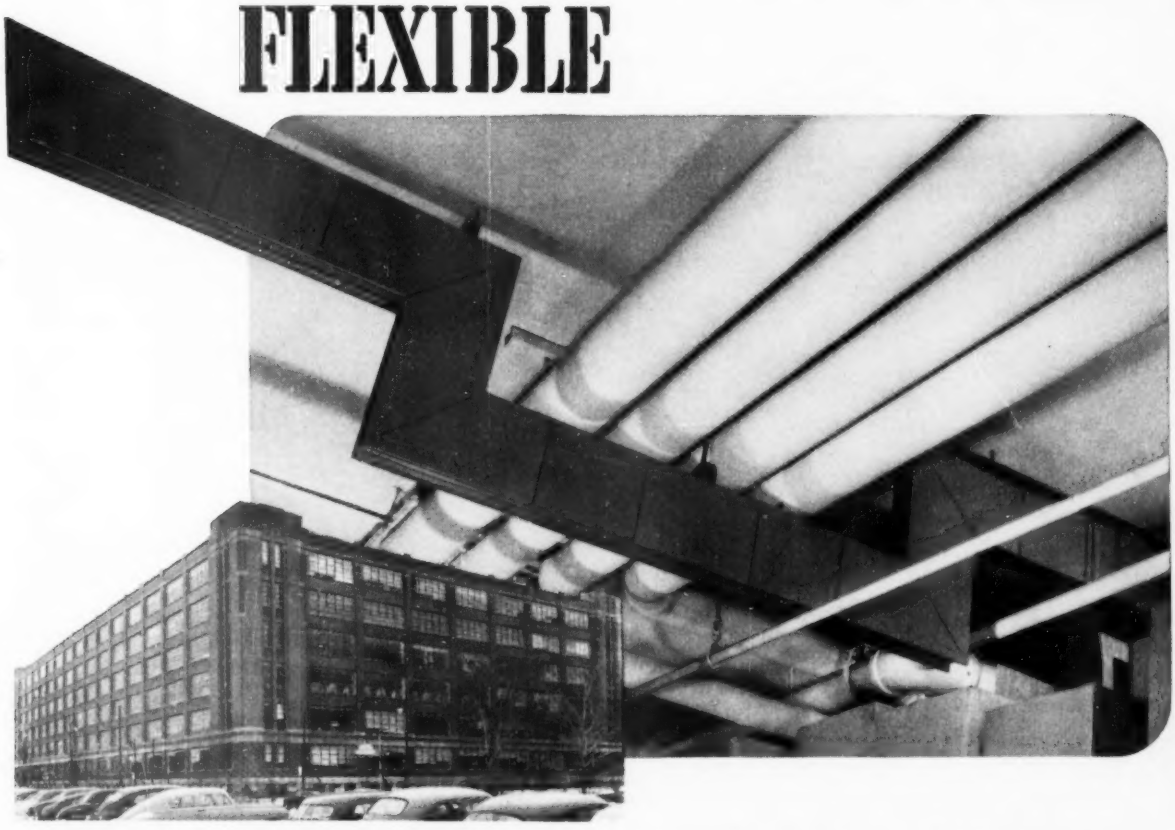
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This vast installation of standardized Low Impedance and Plug-In Bus Duct has recently been completed at the Parke, Davis & Company, Detroit, Michigan, where a complete changeover was made from a d-c to an a-c system.

This duct has greater current-carrying capacity pound for pound than any other means of secondary power distribution. Plug-In Duct has outlets every foot to allow for rapid machine tie-ins. Duct sections are fully salvageable and can be expanded or relocated with little effort.

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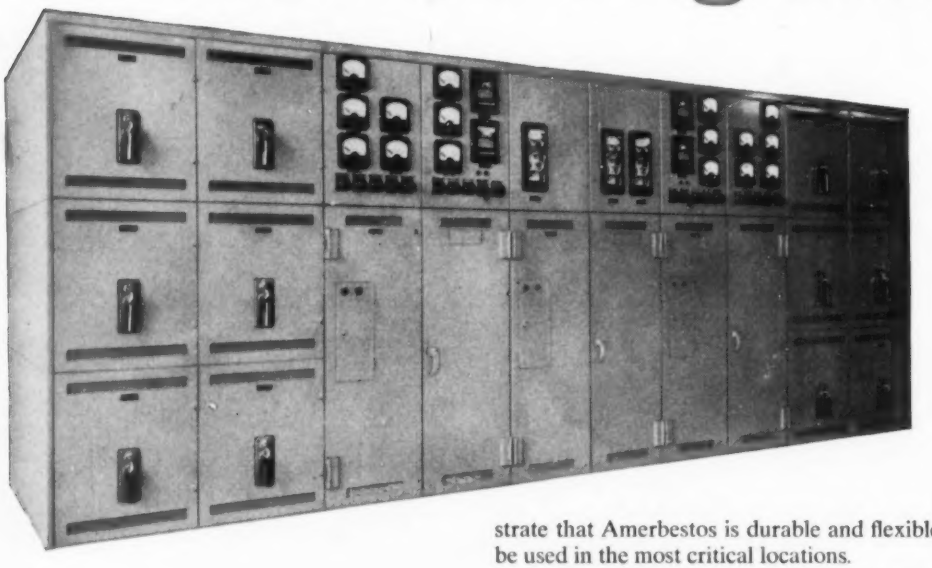
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DESIGN TESTED AND VERIFIED in the Westinghouse HIGH POWER LABORATORY

APPARATUS DISTRIBUTOR WESTINGHOUSE

"We've got to have a and we're getting



I-T-E says, "Our switchgear goes into central power plants that serve entire cities. The failure of *one wire* could shut down a million-dollar turbine and cause a total power blackout. Process plants could lose millions in ruined products and interrupted production. The stakes are too high for us to use anything but a top quality wire, and we're getting it with Amerbestos."

For the switchgear shown here, I-T-E uses U·S·S Amerbestos 90C type TA: copper strand—thermoplastic insulation—felted asbestos—flame-resistant cotton braid. The homogeneous thermoplastic insulation gives excellent moisture protection; and, even more important to I-T-E, it can be bent to a much shorter radius than helically-wound insulations. As a matter of fact, I-T-E found that after a bending test, this type of Amerbestos construction could withstand a breakdown voltage *20 to 30 times* higher than helically-wound insulations. While this was an unusually severe test, it does demonstrate that Amerbestos is durable and flexible enough to be used in the most critical locations.

Since the very reputation of I-T-E is built upon the high quality of their product, they demand close quality control from suppliers, too. "And," says I-T-E, "We know that American Steel & Wire checks, tests and inspects every foot of wire we get." I-T-E also remarked that the Amerbestos conductors are always well centered in the insulation, and the thermoplastic insulation shows no tendency to flow or become brittle.

You can get this same high quality from American Steel & Wire no matter what kind of wire or cable you use. Send the coupon and get more information about Amerbestos; or, better still, outline your wire or cable problems and give our engineers a chance to help you.

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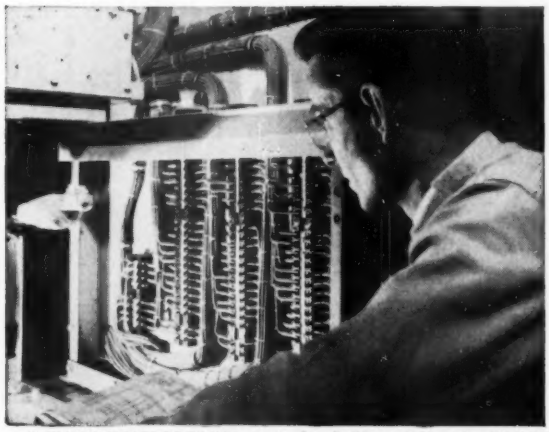
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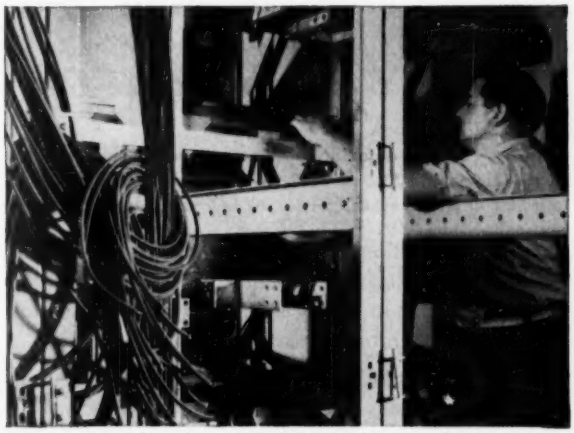
U·S·S AMERICAN ELECTRICAL

top quality wire it with Amerbestos"

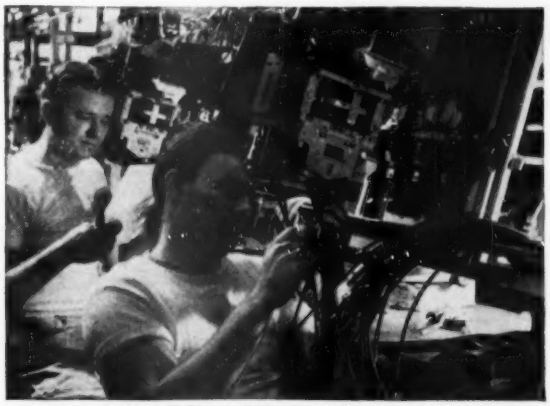
says I-T-E Circuit Breaker Co., Inc., *world-famous switchgear manufacturer*



THIS LOW-VOLTAGE BOILER control switchboard contains 22,000 feet of Amerbestos. It has 11 circuit breakers, is being built for Astoria, N. Y. generating station of Consolidated Edison.



HERE, an electrician wires a 600v I-T-E Multimite switchboard. It has 9 compartments, 7 for circuit breakers, 2 for instruments. Notice extreme flexibility of the Amerbestos wire.



EACH OF THESE I-T-E type KB circuit breakers contain 22 feet of Amerbestos. In this photograph, workmen are wiring the circuit breakers up to the terminal blocks.



UPPER SECTION of this photo is the main power bus on the Consolidated Edison switchboard. Wiring duct cover has been removed to show the 298 wires that occupy the compartment.

SPECIAL Job!

- mold cured portable cord
- machine tool & building wire
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World's only fully-locking steel framing material

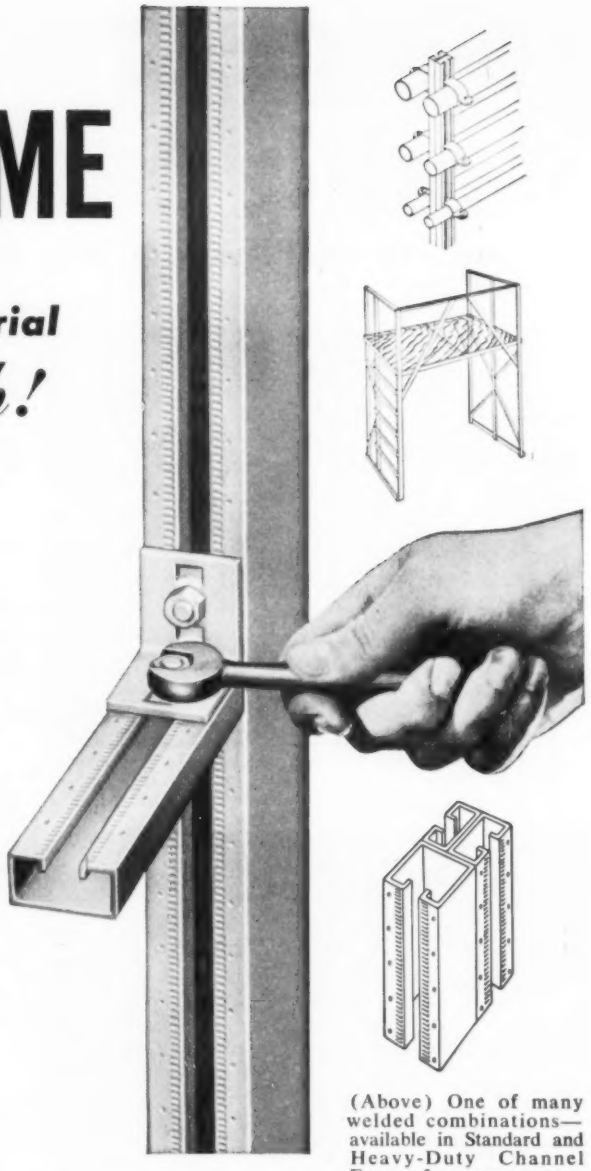
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MULT-A-FRAME, amazing new fully-locking steel framing material with 1000 and ONE uses, lets you frame, hang or support anything faster, easier, at low cost!

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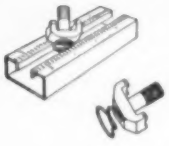
Get skyscraper strength without bulk for racks, supports, scaffolds, platforms, hangers, inserts, rigs, cribs, mobile parts carriers, etc. No scrapping . . . **MULT-A-FRAME** can be used over and over again. A wide variety of fittings is available to fit any job.

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(Above) One of many welded combinations—available in Standard and Heavy-Duty Channel Frames for every purpose.

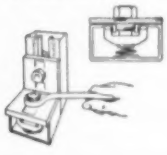
3 basic parts
. . . 3 easy steps



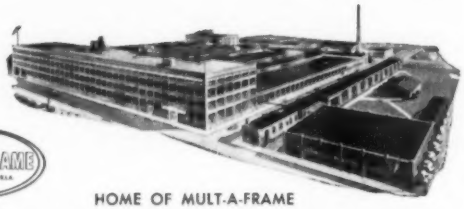
1. Push Spring-T-Bolt into Channel Frame slot anywhere along frame. Give it a one-quarter turn. Long bolt stem easily held.

2. Locate Spring-T-Bolt at desired position and release. Contact points are forced into serrations holding T-Bolt in place.





3. Attach Safe-Locking Fitting and tighten nut. Nubs on Fitting "key" into Channel Slot and prevent rotating about bolt.



HOME OF MULT-A-FRAME

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Saved $15,000 on 50,000 fastenings into steel

Fastener cost reduced from $2.53 to 24 cents

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Lowered fastening cost 87%; reduced time 90%

Split-second fastening into steel or concrete with super-speed *Ramset Jobmaster*

FASTENING SYSTEM



Just as thousands of users have been saving for six years, you can slash cost and time of fastening into steel or concrete with RAMSET SYSTEM, pioneer in powder-actuated fastening.

Let us prove, on your own work, how the ten big features of the new RAMSET JOBMASTER add up to new speed, new economy, new ease, new utility. See the lightning-fast action—one-hand operation—accuracy of positioning—straight, firm penetration which only the JOBMASTER gives you.



Ask your dealer to do a sample job for you, and prove the dollars-and-cents value of doing every fastening job with RAMSET.

Always use Tru-Set Fasteners

Exclusive Red-Tip Pilot guides them straight to the work, with highest efficiency in performance. Four types in 56 sizes for split-second fastening into steel or concrete.



✳ Names of these RAMSET users and others in your locality available on request.

Ramset Fasteners, INC.

Ramset Division, Olin Industries, Inc.

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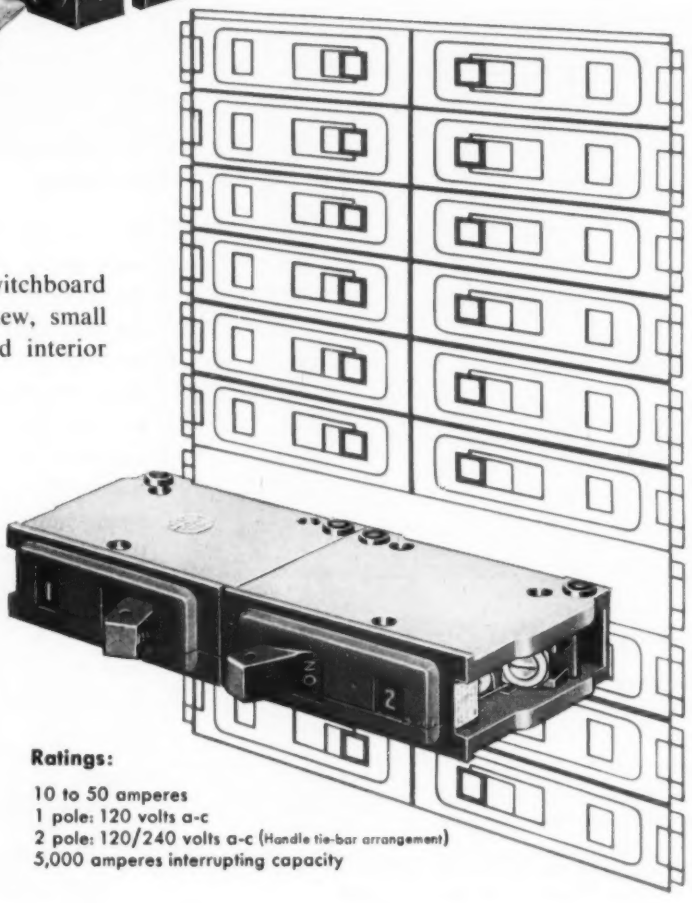
NOW — a new I-T-E

with complete panelboard interior mounting design



providing:

- *extra compactness*
- *extra flexibility*
- *extra convenience*
- *extra quality*



I-T-E is now furnishing independent switchboard builders and electrical manufacturers a new, small EQP *plug-in* circuit breaker and associated interior mounting accessories in an equally new I-T-E panelboard design.

Industrial, commercial, and residential panelboards and load centers can now be reduced as much as 25% in size —without sacrificing quality in circuit breaker protection.

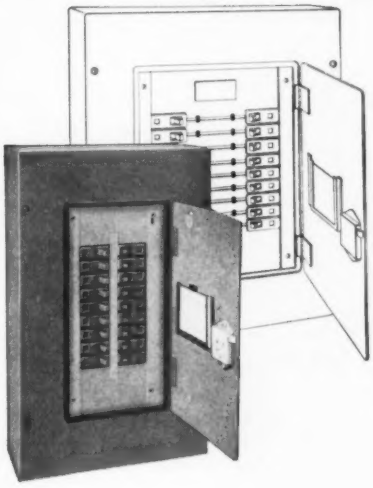
Newly designed I-T-E mounting accessories make possible flexible, compact interior panelboard assembly. The new, small EQP circuit breaker provides:

1. **Thermal-magnetic tripping**
2. **Quick-make, quick-break operation**
3. **Trip-free action**
4. **Time-saving plug-in design**

Ratings:

10 to 50 amperes
1 pole: 120 volts a-c
2 pole: 120/240 volts a-c (Handle tie-bar arrangement)
5,000 amperes interrupting capacity

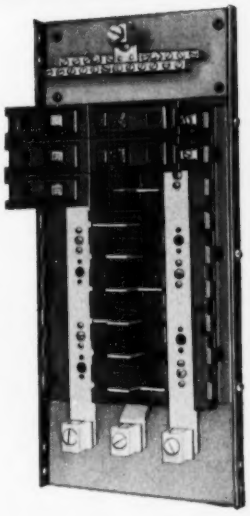
plug-in circuit breaker



FROM COAST TO COAST

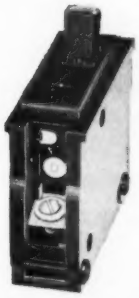
. . . Leading independent panelboard builders are now offering flexible, new I-T-E plug-in panelboard design

Panelboards are now reduced as much as 25% in size, through use of the new I-T-E design. New design provides from 12 up to 42 circuits, sequentially phased for single-phase three-wire 120/240 volts a-c or three-phase four-wire 120/208 volts a-c.

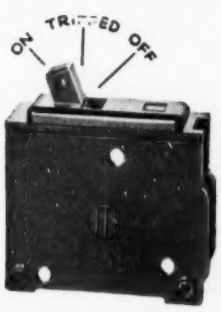




Plug-in pressure-type contacts enable EQP breakers to be clipped directly on bus stabs. Mounting is positive, safe.



Load terminals are securely mounted—easily accessible for quick connection of leads.



Three-position operating handle clearly indicates whether breaker is ON, TRIPPED, or OFF. Service can be restored in a hurry when breaker trips on overload.

Remember—

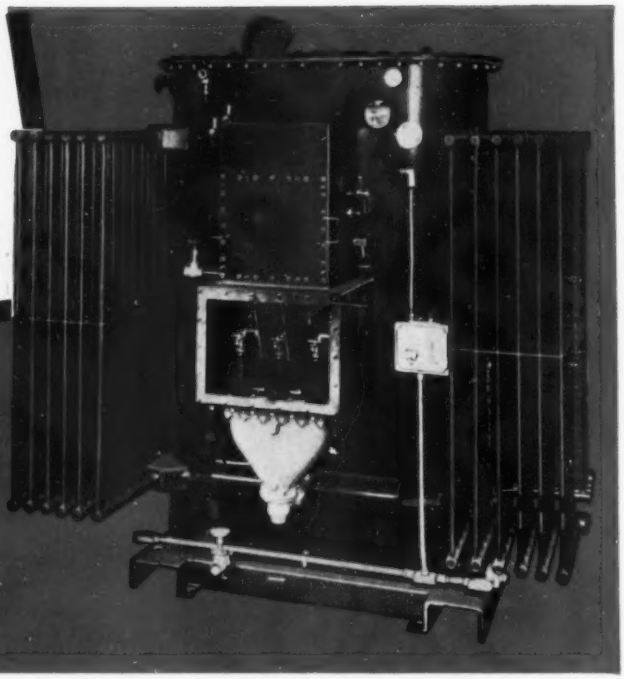
You don't have to compromise with quality to utilize the new, compact lighting panelboards and load centers now available. Specify I-T-E EQP circuit breakers—and I-T-E panelboard construction—throughout. Your local panelboard builder will gladly give you details.

I-T-E

MOLDED CASE CIRCUIT BREAKERS

I-T-E CIRCUIT BREAKER CO. • 19th and Hamilton Streets • Philadelphia 30, Pa.

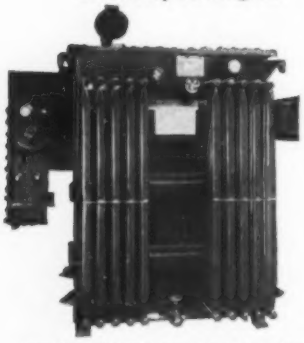
MOLONEY *Askarel* TRANSFORMERS



1500 Kva 13200-2400 volt Askarel Transformer with HV selector type disconnect switch and terminal chamber equipped with two sets of cable connections to provide a preferred and emergency feeder to the transformer.



500 Kva 4800-240 volt, three-phase, sixty cycle, Askarel Load Center Transformer with throats for connection to primary and secondary switchgear.



500 Kva 4160Y-240 volt, three-phase, Moloney Askarel Transformer with primary disconnect and secondary throat connection.

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Where Non-inflammable Transformers are required—either Indoors or Outdoors

Because Moloney Askarel Transformers are cooled and insulated with Askarel, a non-inflammable liquid, they are suited to use in applications where oil-cooled transformers would be hazardous to life and property.

Askarel Transformers are ideal for indoor installations. However, their weatherproof construction permits outdoor installations such as in mines, on roofs, in street and sidewalk vaults for a-c network systems, etc.

Askarel Transformers effect savings in installation costs because expensive fireproof vaults are not necessary. Because the transformer can be located at the center of the electrical load, expensive runs of secondary copper are eliminated. This also provides improved voltage regulation.

MEB2-26

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Manufacturers of Power Transformers • Distribution Transformers • Load Ratio Control Transformers Step Voltage Regulators • Unit Substations

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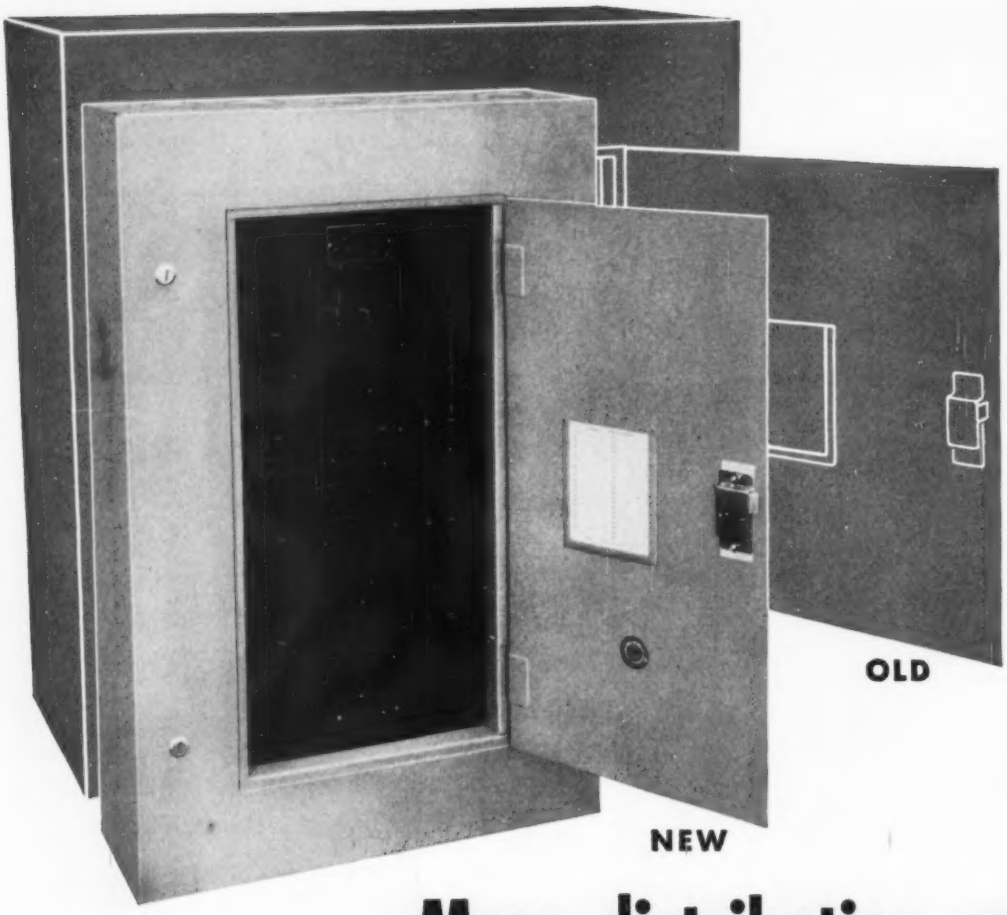
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More distribution capacity in less space

Here's a more compact Convertible Distribution Panelboard for 240-volt, a-c* applications, up to 600-amp capacity with main lugs, or 225-amp main breaker with branch circuit breakers up to 100 amperes, 1, 2 or 3 pole.

This new NDP Panel supplements the well-known Westinghouse Type CDP Convertible Distribution Panel. In a cabinet 20″ wide, it is now possible to obtain circuit capacities for single phase as well as 3 phase and 3-phase 4-wire service, which formerly required the use of 30″ wide cabinets.

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*—*also 125/250 volt, 3-wire d-c systems*

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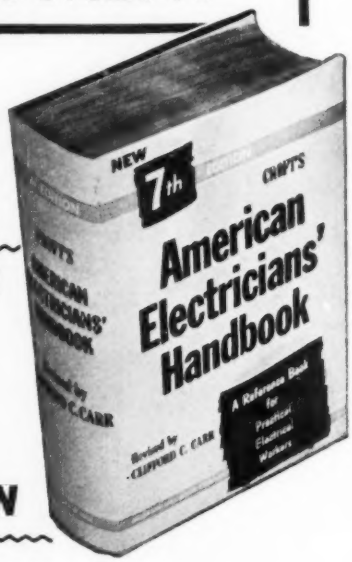
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PLUS over 400 dependable tables that cover everything from determining profits and discounts, diameters and weights of common wires and cables, to trouble-shooting tables on motors and generators that let you localize faults in a jiffy.

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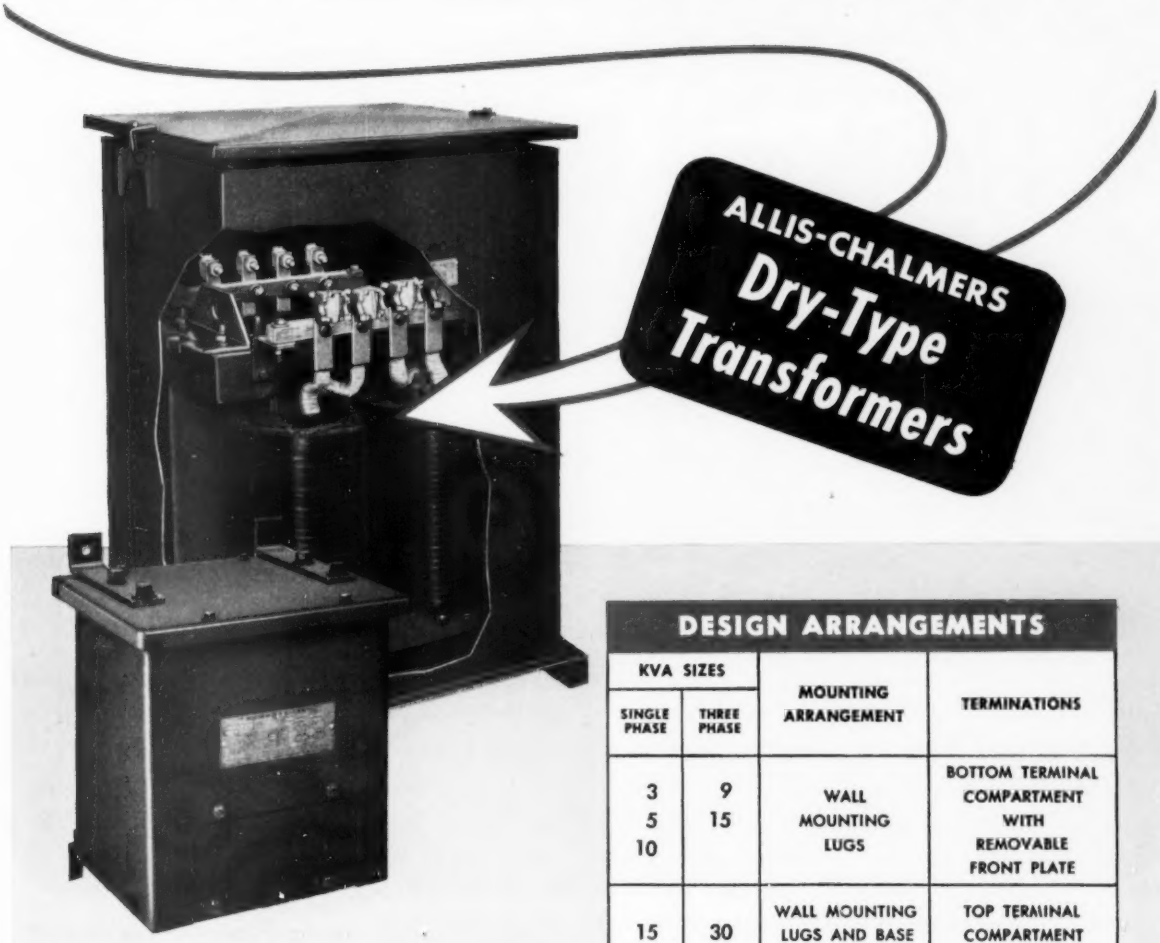
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"Boloney," you say?...

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depends on *how you look at it.*

Actually this job cost somewhere around a thousand dollars . . . and probably is typical of many jobs you've sold. A relatively small job, true... but well engineered.

But where does the $50,000 job come in? As we said before, it depends on *how you look at it.* To be more precise, if you could turn one good job into 50 similar jobs, you could hit that elusive 50 thousand mark. Yeh . . . that's the rub. But how do you turn one job into 50?

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Dear Sir:
Please send me.....copies of the Rules Brochure and.....Entry Forms for the LIGHTING COMPETITION FOR ELECTRICAL CONTRACTORS.

NAME _____

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ADDRESS _____

CITY _____ ZONE _____ STATE _____

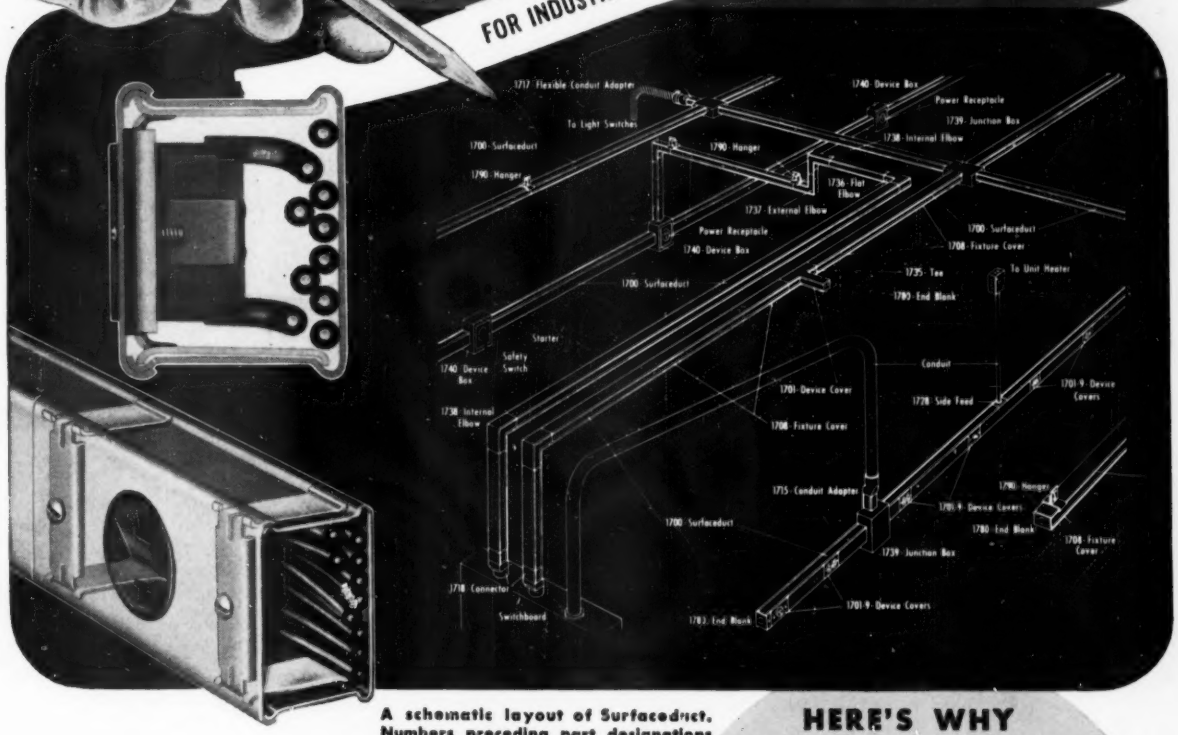
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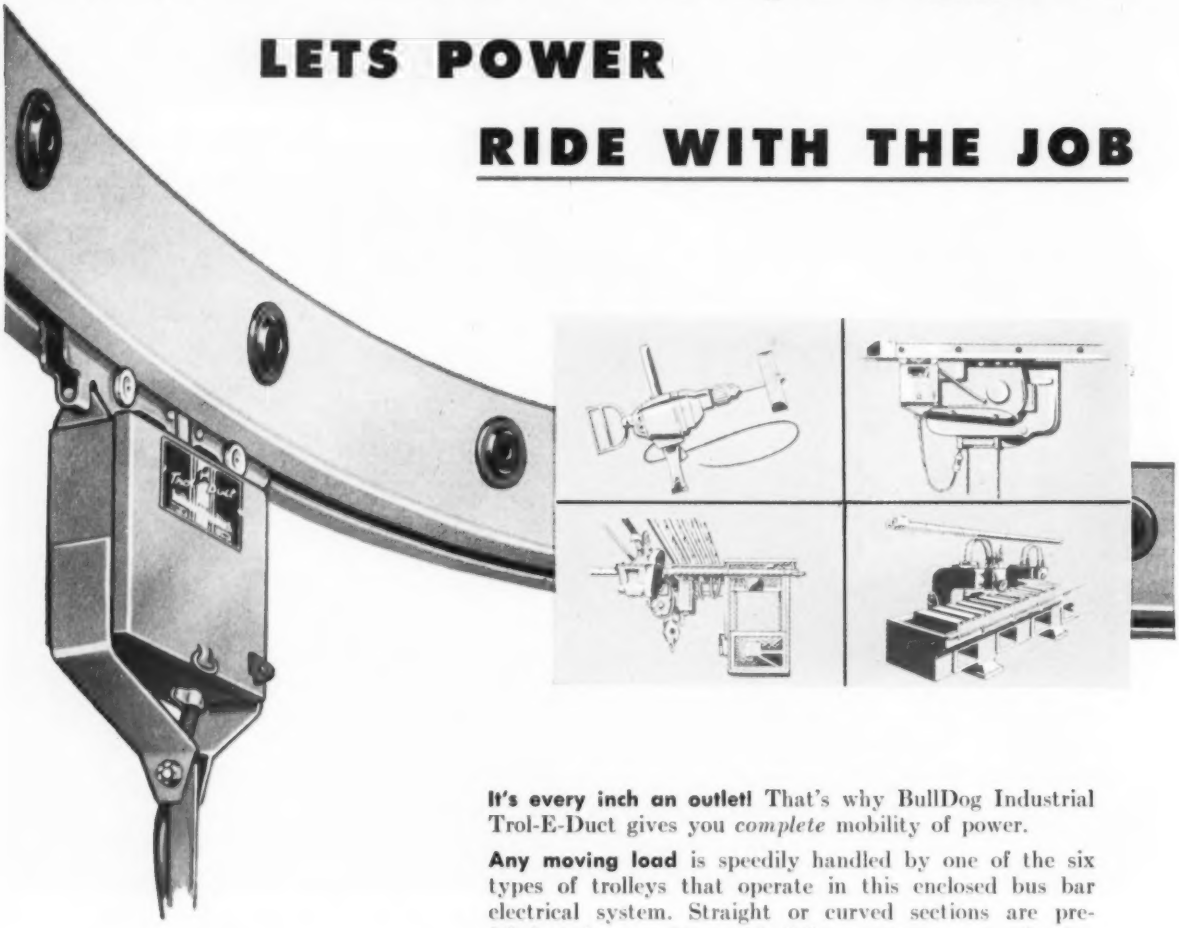
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Completely reusable, Industrial Trol-E-Duct brings you substantial production gains because it practically eliminates "downtime." Trolleys can be removed and replaced without current shut-down . . . no sagging wire conductors to halt production for maintenance. There's no more time wasted hunting for a free outlet . . . no more messy, dangerous extension cords.

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BULLDOG

ELECTRIC PRODUCTS COMPANY

Washington Report

An atmosphere of uncertainty and inactivity seems to prevail in Washington currently. This is especially true in the lower echelons of executive authority, and is causing some confusion. But this apparent negativism is deceiving. It is Administration-planned, and calculated to produce positive results.

There are several reasons for the current lack of positive actions for headline attention. First, newly-appointed officials, new in their assignments, are busy assimilating all the facts about their respective responsibilities, with many conducting new studies and research on their problems. Second, Russia's successor to Stalin, Malenkov, has made what are considered by many as possible overtures for peace negotiations, which the Eisenhower Administration feels cannot be ignored. These officials are therefore adopting a policy of "wait and see." Until Russia's future policy and intent becomes more clear, decisions on most major foreign and domestic issues will be made slowly and with caution.

A new materials control plan is scheduled to take effect July 1 to replace CMP, which expires June 30. It will be called Defense Materials System, or DMS, and will permit free buying of all metals except for those needed as defense set-asides. Under it, holders of defense contracts and some "defense supporting" companies will get a priority for materials, allocated on the basis of quantities needed to deliver products involved on a specific date.

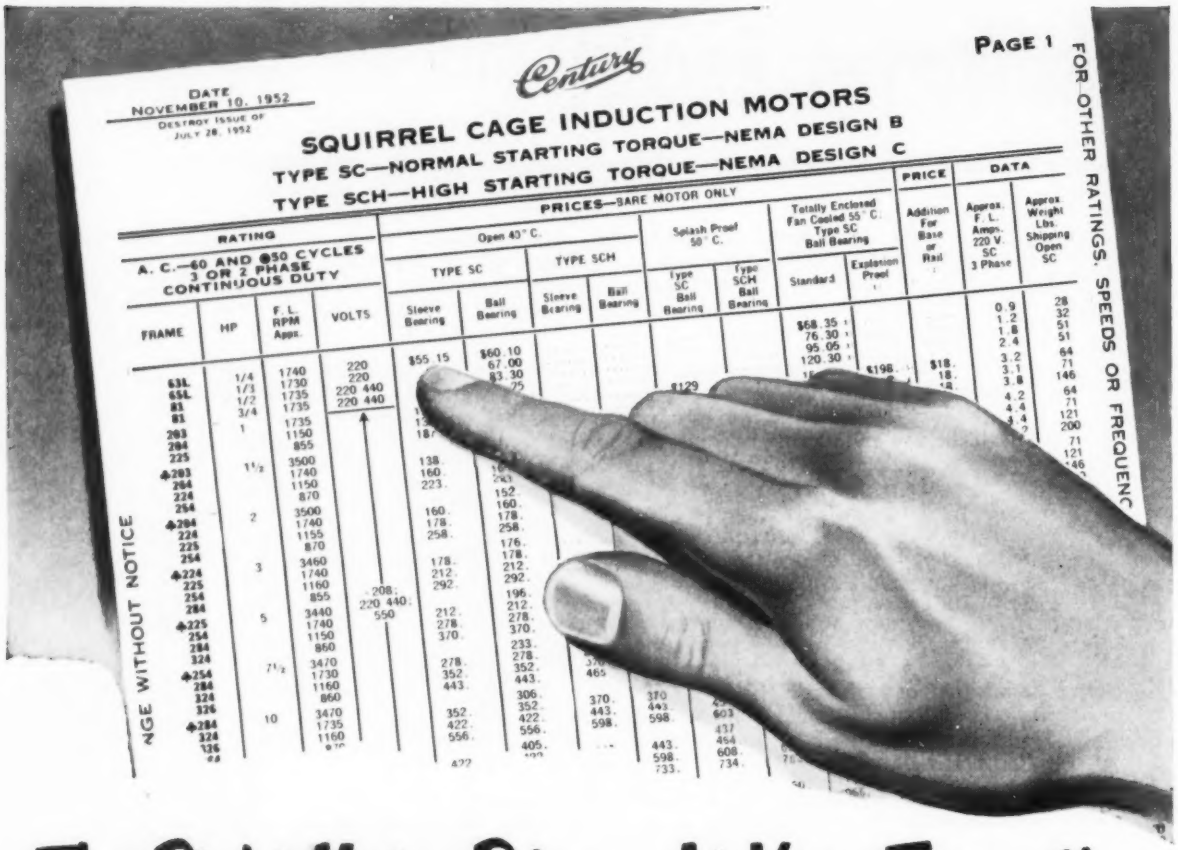
U. S. economic conditions improved during this year's first quarter, Commerce Secretary Weeks reported recently. Business activity exceeded the last three months of 1952, he said, and manufacturers' expansion programs reflected "solid confidence" in the business outlook. Capital expenditures for plant, machinery and equipment this year will top 1952's $26.5-billion, he predicted. And personal income is running at an annual rate of $280-billion, up $3.5-billion above the pace set during last year's final quarter.

All direct price controls ended six weeks ahead of the April 30 deadline set for expiration of the price-wage control authority. Put into effect January 26, 1951, these controls were administered by the Office of Price Stabilization, staffed at one period by more than 12,000 employees. When the last items were decontrolled, 1300 employees were still on the payroll, all eligible for 30-day dismissal notice. About 100 are to be retained through May to liquidate the agency. This early decontrol action makes possible return to the Treasury of about $1.5-million of the $36.9-million alloted for its last 10 months' existence.

Capital expenditures by business in 1953 will total about $27-billion, according to a recent survey of capital budgets conducted by Dept. of Commerce and Securities Exchange Commission. Covering new plants and equipment, these expenditures compare with $26.5-billion in record 1952, and $25.5-billion in 1951. Greatest increase is predicted for public utilities, at 14% ahead of last year. Durable goods industries show an estimated 5% cut-back, while non-durable-goods industries show a 5% increase.

Aluminum production in January was 89,900 tons, 8% above December and 17% above January production of last year. This was only 4% below the record 94,050 tons made in wartime October 1943. Despite opposition from the "big three" primary aluminum producers, Government plans to stockpile aluminum at a progressively accelerated rate for the balance of 1953.

A new Office of Defense Mobilization which will embrace what's left of the old controls agencies (DPA and NPA) plus the Munitions Board and National Security Resources Board has been asked for by President Eisenhower. This new ODM would take over stockpiling activities as well as plans for production of materials.



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APRIL . . . . at a Glance

Rectifiers

The idea of a simple switching rectifier has intrigued engineers and inventors for decades. If it were possible to design a synchronous mechanical device that would switch an ac current at the precise instant that the current goes through zero, large dc currents could be obtained at very high efficiency from ac lines. During World War II, German engineers tackled the problem in a unique way. They used saturable reactors to flatten the current wave at zero and to provide a very brief, but practical, instant of time for synchronous mechanical switching. The principle is now incorporated in an American-made mechanical rectifier. An installation by Mainco Electrical Contracting Corp. serving a 30 kw load in a New York printing plant is described by J. F. McPartland in "Powering a Printing Shop with Mechanical Rectifiers," page 82.

Power For Defense

Cadillac's mammoth tank plant in Cleveland has a connected power load of over 65,000-kva, incorporates 2500 heavy machine tools and nearly 12,000 motors with capacities up to 600-hp. Serving this giant is an electrical system featuring 4800-volt distribution, 19 substations, miles of armored cable and busduct. The story of this installation, as well as the maintenance program in effect to keep the plant at peak production, is a study of high-order engineering, organization and methods. You will find it on page 63.

Training

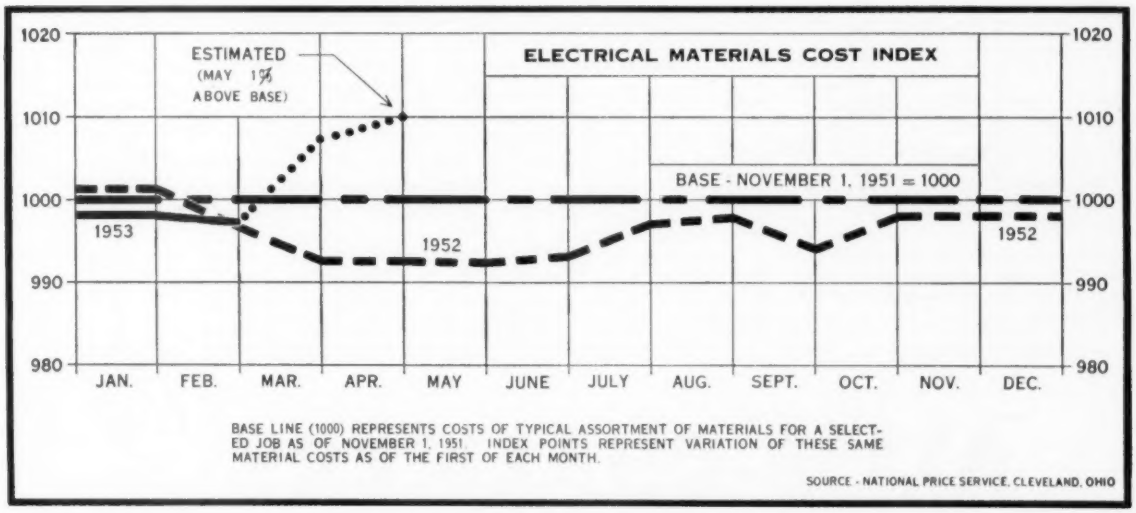
A small percentage of the cost, to the electrical construction industry, of bad judgment and errors in estimating would fund the most extensive educational program. But an organized training or refresher course for estimators need not be expensive. Minnesota electrical contractors, with the cooperation of the University of Minnesota's Center for Continuation Study, are conducting a travelling estimating school to reach contractors in all parts of the state. Middle West Editor Gus Eckel (an experienced electrical estimator himself) caught up with the school at Winona where he sat in for the course. He tells the story, "Minnesota's Travelling Estimating School," beginning on page 72.

Expandable

Several current trends in electrical system design are featured in Black & Decker's new plant wired by Blumenthal-Khan of Baltimore. Plug-in bus duct lines on 60 foot centers provide flexible distribution of 480/277 volt power throughout the plant. The fluorescent lighting system is also served at 277 volts operated by remote control contactors. Portable tool power is taken off trolley duct lines powered from the bus system through 480/120 volt transformers. The story, "A Plan for Electrical Expansion," begins on page 96.

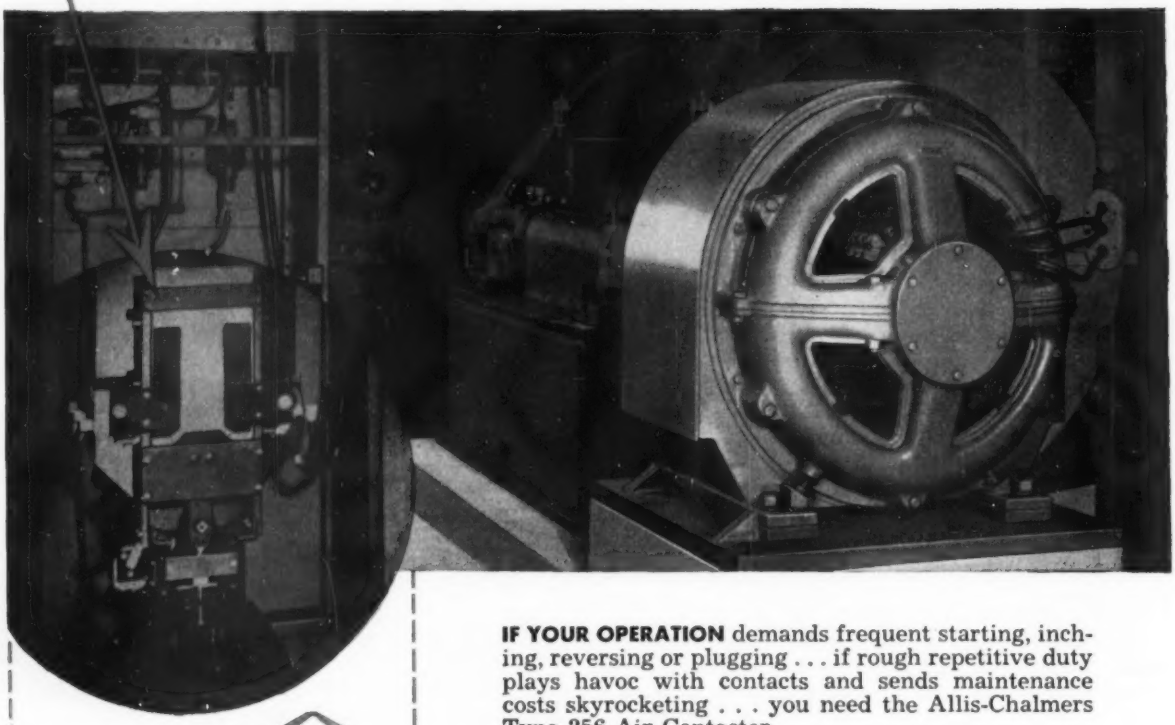
Frost Control

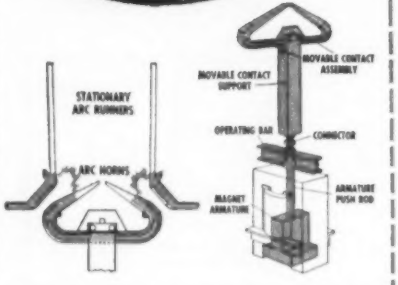
An electric heating installation at Cross Brothers Meat Packing Company in Philadelphia prevents frost damage to floors. The installation, one of the most unusual applications of electric heating we have encountered, consists of electric coil heating cables under precise thermostatic control in the floors of cold storage rooms. Sub-floor temperatures are kept slightly above freezing preventing frost heaving and damage to the floor. "Heating Cables Protect Cold Storage Floors" page 86 is the story of this installation and incidentally an application of electric heating to a problem almost impossible to handle by any other heat source.



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TYPE 256
Air Contactors

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Double-break contacts, vertical action, dual blowout structure and other features speed arc extinction . . . assure long life and low maintenance.

IF YOUR OPERATION demands frequent starting, inching, reversing or plugging . . . if rough repetitive duty plays havoc with contacts and sends maintenance costs skyrocketing . . . you need the Allis-Chalmers Type 256 Air Contactor.

No Turning Shafts — No Shaft Bearings

The elimination of turning shafts, shaft bearings and flexible contact leads minimizes mechanical wear. Double-break contacts of arc resistant alloys, *operating in air,* straightline vertical action and fast arc extinction add months of contact wear. Actual case histories of "once-a-minute interruption" duty have revealed little contact wear in a full year's operation.

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Compact design permits installation in a cubicle used for oil immersed units in existing starters. And, of course, the Type 256 Air Contactor is also available in Allis-Chalmers Type H Starters.

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ELECTRICAL CONSTRUCTION AND MAINTENANCE

52nd Year—APRIL • 1953

Air Conditioning Loads

IT HAS BEEN ESTIMATED that out of the million or more homes to be built this year approximately 50,000 will have central summer air conditioning systems installed. Room cooler sales are also expected to exceed last year's record of 341,000 units. Residential air conditioning, a rare luxury only a few years ago, is now a going business with annual sales running into nine figures and every prospect of continued growth.

RESIDENTIAL AIR CONDITIONING offers a challenge to wiring design that cannot be met by the stop-gap measures by which these loads are now being handled. Room coolers are plugged into an existing circuit which is almost invariably overfused or the circuit protection is deliberately disabled. On the rare installation where the essential full circuit is provided, it is often connected to overloaded service equipment. New central air conditioners are often installed without additional system capacity.

EVEN THE SMALLEST ROOM COOLER is nearly a full circuit load. These loads, furthermore, are continuous. Diversity, which conceals a multitude of engineering sins in the application of intermittent loads, offers no protection. The full load requirements of air conditioning must be added to conventional wiring systems if other electrical requirements are to be served adequately.

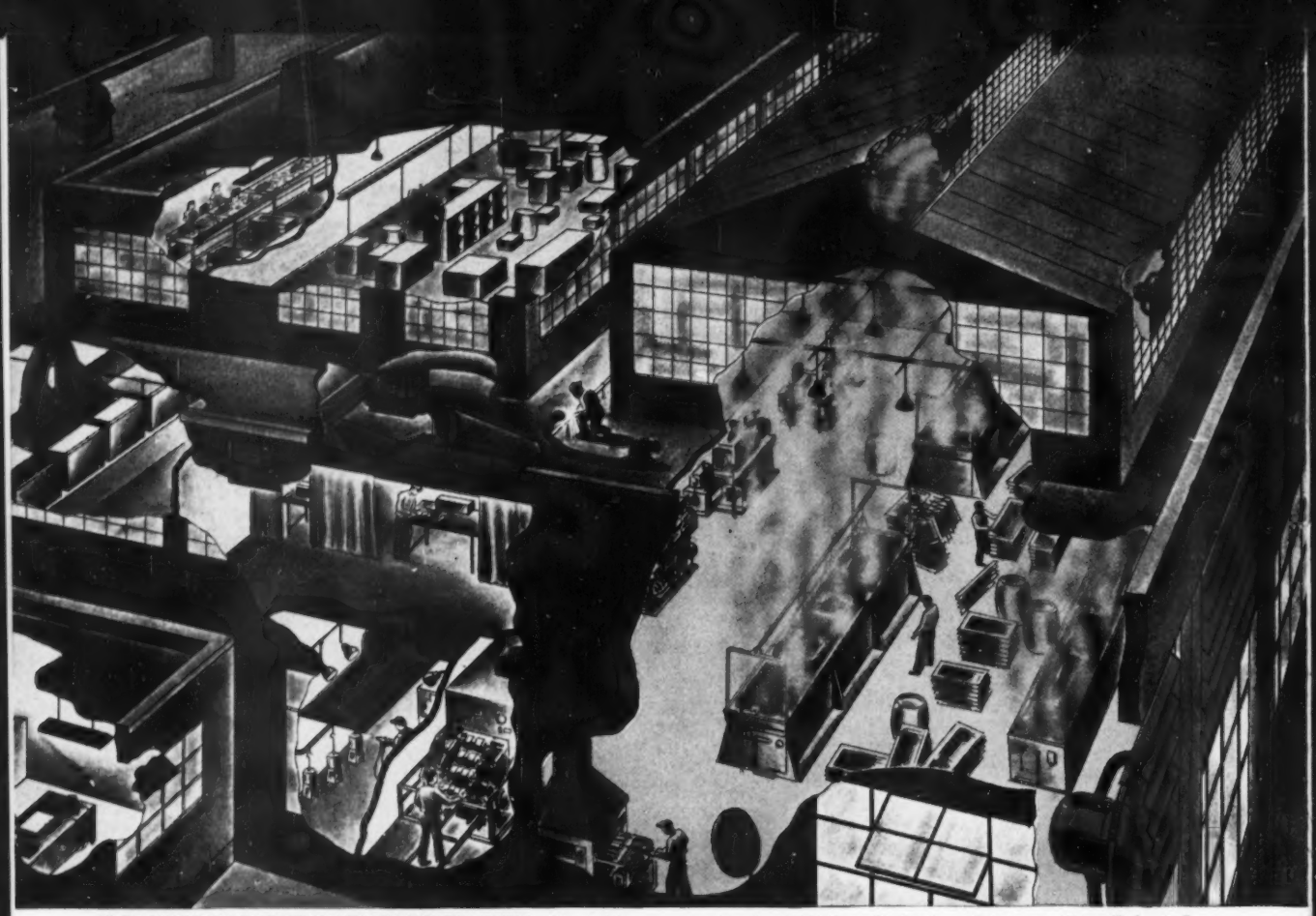
FOR ADDITIONAL SERVICE CAPACITY, approximately 3 w. per sq. ft. is required for air conditioning. Insulation, glass area, exposure and ventilation are among the factors which must be considered in the actual equipment application. However, the above approximation is estimated to provide sufficient capacity to serve the average central air conditioning installation.

BUT WHAT ABOUT ROOM COOLERS? These are usually "portable" plug-in appliances. Are these the buyer's grief, or does the electrical industry have a clear responsibility to provide system capacity to serve them? Should the Code require additional service capacity and full circuits for future room coolers to avoid dangerous overloading of general purpose and appliance circuits? These are not easy questions, but we are going to need practical answers—and soon.

CONTINUOUS, HIGH WATTAGE, low power factor loads of air conditioners are already uncovering the desperate inadequacy of many existing wiring systems. The phenomenal pace of room cooler sales indicates beyond question that summer cooling will become as common as food refrigeration. The loads are easily predictable.

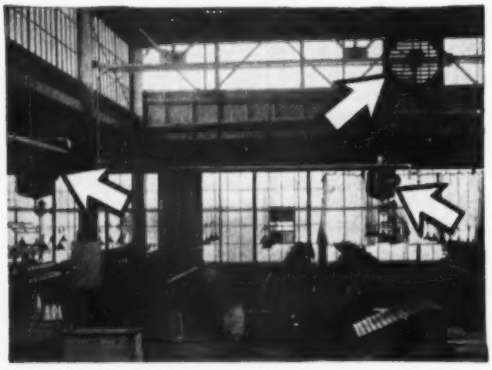
HERE IS A CLASSIC TEST of industry responsibility. The alternatives are clear. It is either the owner's responsibility to provide for essential electrical service and circuit additions as he acquires air conditioning equipment, or it is the electrical industry's responsibility to provide basic wiring system capacity and circuit accessibility in the original installation to serve the predictable air conditioning load.

Wm. T. Stuart



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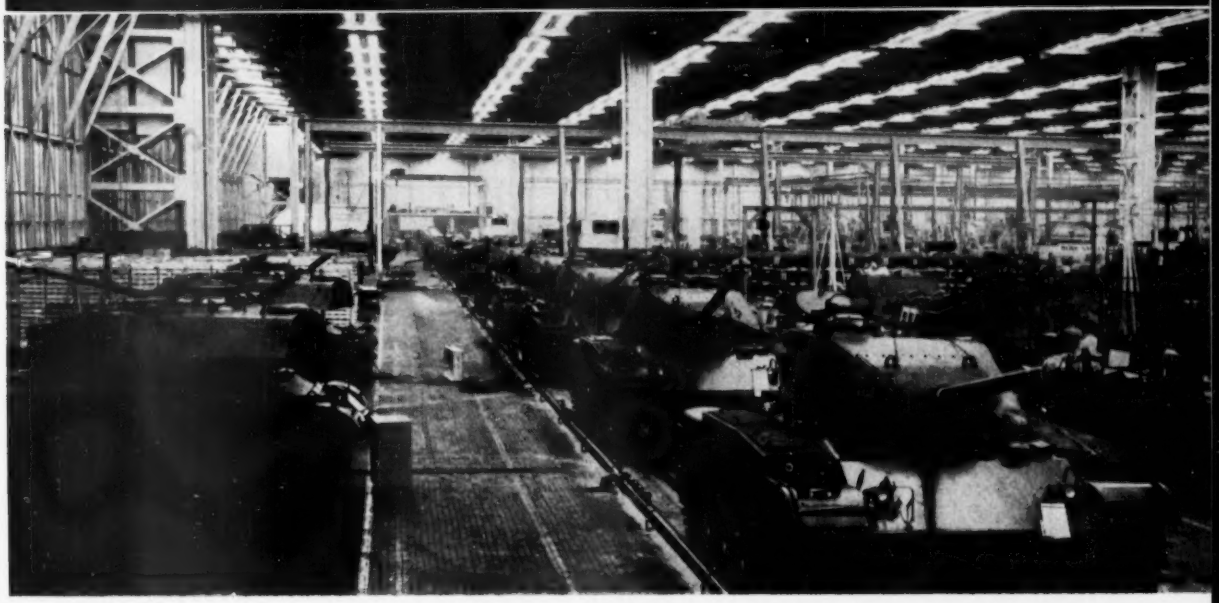
Remember, Graybar is an all-inclusive source for everything electrical. We distribute over 100,000 electrical items for wiring, lighting, communication, power as well as ventilation. *Graybar Electric Co., Inc. Executive Offices: Graybar Building, New York 17, N. Y.*

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BULLDOG TANKS, America's finest lightweight fighting machines, are the end product of 2500 heavy machine tools driven by nearly 12,000 motors backed by a rugged, flexible, high-capacity distribution system.

POWER for Tank Production

Cadillac's giant Bulldog* tank plant in Cleveland covers nearly 40 acres, has a connected power load of 65,500-kva, incorporates 2500 heavy machine tools, nearly 12,000 motors and over 2500 lighting fixtures. It also has 19 substations, a 4800-volt distribution system, miles of armored cable and bus-duct. This mammoth defense-prompted job called for electrical engineering and construction of a high order. It also requires a coordinated preventive maintenance program combining scheduled inspections, planned shut-downs, accurate records, adequate inventories of replacement parts, trained personnel, availability of proper tools and testing instruments.

CADILLAC'S Walker "Bulldog" tank plant utilizes 12,000 motors with capacities up to 600 horsepower, is illuminated by over 50,000 fluorescent lamps and accommodates 2500 heavy machine tools. Miles of busduct, 19 substations and over 3000 separate items of electrical equipment are other comment-prompting totals.

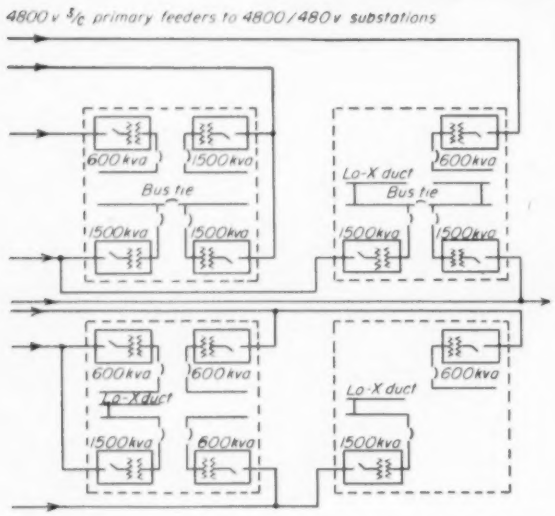
The figures are imposing, yet to electrical men significance of the job lies not in size alone but in the speed and methods by which this former down-at-the-heels storage depot was converted and expanded to supply high-voltage flexibility for its present heavy-production role.

Major alterations and fast decisions were numerous. Much of the planning was done on the job-site as the work progressed. Electrically, this transition concerned contractors Dingle-Clark (who installed outdoor 132/4.8 kv transformers, indoor primary switchgear, reactors and all inter-related wiring), H. B. Durkee (who picked up at the 4800-volt feeder breakers and continued through the plant), and numerous firms doing smaller segments.

In a matter of days assembly lines were plotted, rates of production determined probable power peaks figured, crane runs located, busduct lines shifted or added and special load centers analyzed. Primary service was more than doubled to give the plant a power potential of 34-million volt-amps.

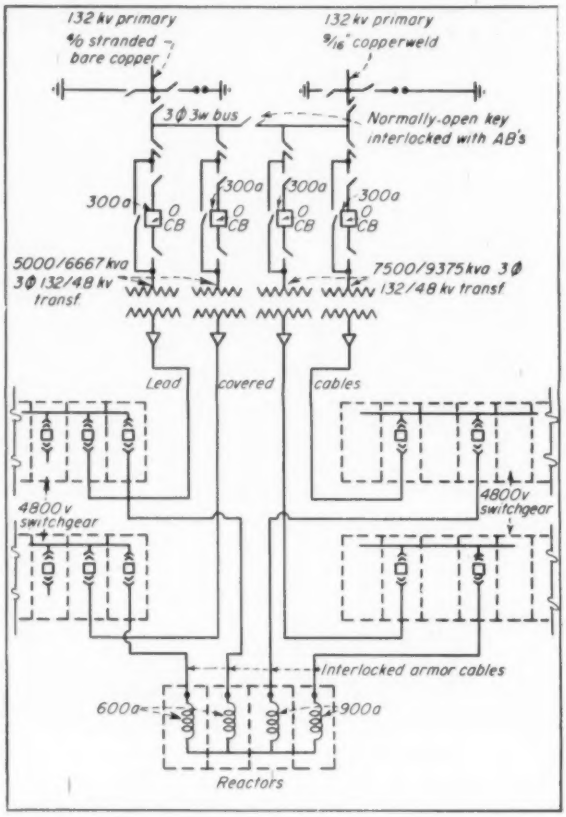
Since much of the equipment required for tank production didn't even exist when the Army took possession of the plant, much of it had to be designed, or located as surplus stock, then modified for special applications. Yet, despite these problems, the first completed Bulldog lumbered off the assembly line just seven short months after the go-ahead was received.

*The Walker Bulldog (named for General Walton H. Walker, killed in Korea) is an all-new piece of American fighting equipment. Weighing 26 tons and sheathed with homogeneous armor, it mounts a high-velocity 76-mm gun, travels at 40-mph and is manned by a 4-man crew. Pound for pound it will outmaneuver and outshoot any other tank in the world.



LOAD CENTER basement-based 4800/480-volt substations (19 in all) contain from 1 to 4 askarel-filled 3-phase transformers each. Several of the 1500-kva units are cross-connected on their secondary sides through bus tie breakers interlocked with main feeder breakers to prevent simultaneous closing.

Distribution at 4800-Volts



OUTDOOR SUBSTATION steps 132-kv primary current to distribution level of 4800 volts via oil-immersed transformers flanked by electrically-operated remotely-controlled main breakers. The four sections of a coordinated heavy-duty indoor switching center are connected to a reactor bank.

As indicated by the accompanying primary substation diagram, utility service for this industrial heavyweight is received at an outdoor substation over two 132-kv lines, cross-connected on the primary side of the station by means of a 3-phase 3-wire segmented bus structure containing a normally-open bus-tie breaker. Key interlocking prevents the unification of the bus structure through this tie except when one of the incoming line switches is opened. Horn gap, grounding and disconnecting switches are group operated manually.

Connected to the 132-kv bus through OCBs are two 7500/9375 and two 5000/6667-kva outdoor type oil-immersed self-cooled power transformers having 132-kv grounded wye primaries; 4800-volt delta secondaries. Transformers are gas sealed, using automatically controlled dry nitrogen from commercial cylinders to maintain constant internal pressures and to exclude moisture, dust, fumes and air from enclosures. With oxygen thus prevented from coming into contact with the hot oil, sludging and oxidation are minimized, formations of explosive oil-air mixtures are prevented, contamination of oil is retarded, and the possibility of rust, dirt or water settling into windings is eliminated.

Remote controls for closing and tripping outdoor breakers are electrically operated at 125-volt dc. Heating mechanisms and compressors for these OCBs operate at 230-volt ac.

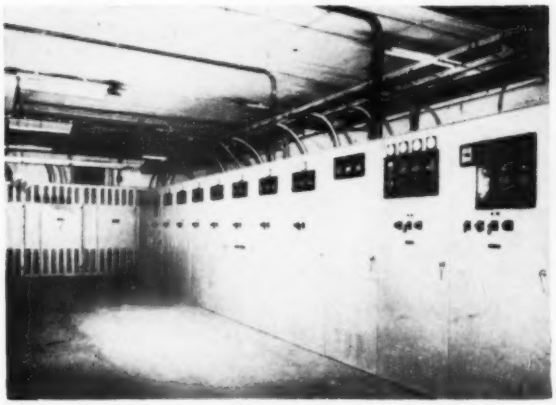
The main 4800-volt switching station is a completely coordinated heavy-duty indoor installation situated in the basement of the plant proper. It consists of four metal-cubicle groupings, each grouping containing a reactor tie and from 6 to 8 feeder-controlling draw-out Magne-Blast air circuit breakers having ICs of 176,000-kva. All feeder cubicles have separate compartments for buses, CTs and breakers. Breakers are disconnected automatically without requiring the unbolting of supports or connections, and they may be raised or lowered, electrically or manually and withdrawn for testing or inspection.

Power connections between outdoor transformers and indoor switch-gear are carried underground through concrete-sheathed ducts. Feeders from the four transformers consist of 7500-volt VCL cables with Flamenol jackets.

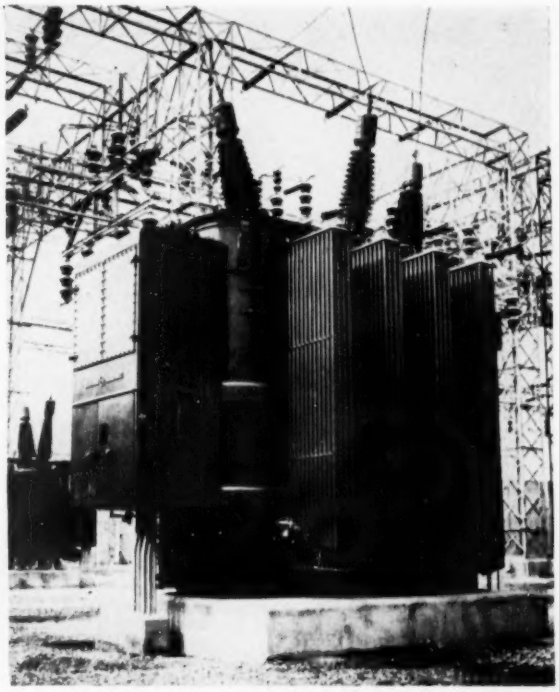
Connections between the four switchgear assemblies and their related reactors are effected through 3-conductor 600-MCM 500-volt varnished cambric interlocked armor cable carried overhead on lightweight open ladder-type racks,

The reactor bank, installed to limit current flow under possible short-cir-

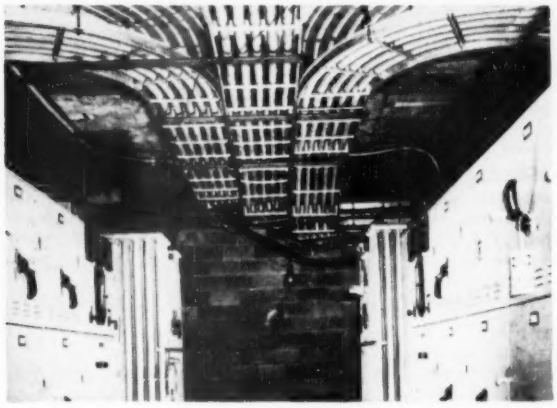
...POWER for Tank Production



MAIN SWITCHING CENTER consists of four cubicle groupings positioned in a U arrangement; each group containing a reactor tie and from 6 to 8 feeder-controlling draw-out Magne-Blast air circuit breakers.



OIL-IMMERSED TRANSFORMERS with 132-kv grounded wye primaries and 4800-v delta secondaries are nitrogen-sealed to maintain constant internal pressures and exclude moisture, dust, fumes and air from the enclosures.



INTERLOCKED ARMORED CABLE supported by open ladder racks aided electrical contractors in greatly expanding original distribution system without having to drastically alter structural features of the building.

cuit conditions and to permit the resultant use of circuit breakers having smaller interrupting capacities, consists of two 600-amp and two 900-amp 110-volt units. Reactance range is 4% on 5000- and 7500-kva bases.

For machine operation, reduction of voltage to 480 is obtained at 19 substations. For the most part, these subs are located in the plant basement beneath load centers. Depending upon area functions and concentrations of power-consuming machines, the substations consist either of 1, 2, 3 or 4 three-phase askarel-filled transformers, some cross-connected to each other through bus tie breakers on the secondary side, others not. Main feeder breakers and bus ties (found in substations having 1500-kva units) are interlocked so that bus segments are connected only when a single transformation unit is out of service due to a fault or maintenance shutdown.

In the 19 substations are a total of 40 transformers, the large majority of them having capacities of either 1500- or 600-kva.

To maintain high power factor in the plant, capacitors are located in substation rooms in banks having total ratings of 180 kilovars. There are 23 such banks.

Voltages below 480 (220 for power tools and 110 for lighting) are supplied by dry-type transformers located at centers of utilization. These units are generally of the 50-kva size.

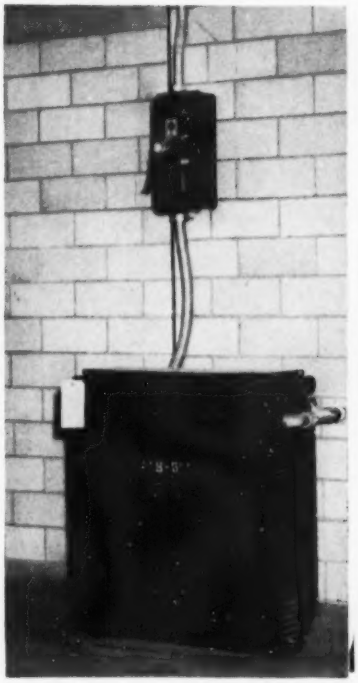
Current distribution mediums at Cadillac include miles of interlocked armored cable, low-reactance and plug-in busduct, trolley-duct and square metal raceways. Each of these current-carrying means was selected to best serve a different purpose, resulting in an overall distribution system having unusual flexibility.

For example, the use of armored cable, supported by open-ladder racks suspended by trapeze hangers secured to the underside of floor slabs and beams, made it possible to greatly expand the original distribution system without altering existing structural features. Long feeder runs could be pulled in quickly, splices were unnecessary, constant visual inspection became possible, future alterations or additions to the system could be easily accomplished, and all installation time was materially reduced. Specially constructed rack having large-radius sweeps were installed where change in direction occurred, and pulling-in operations were also simplified through the temporary positioning of removable rollers along the rack runs. After installation, cables were neatly secured by means of ties passing around rack rungs. Pulling power was provided by block and tackle arrangements and by motorized truck-mounted winches.



SPRAY BOOTH is equipped with vaporproof fluorescent fixtures, a working pit for under-belly inspection, exhaust ducts, pressure tanks for paint, and drag chain to move tank hulls.

Vital to Power Production



DRY TYPE TRANSFORMERS, generally in the 50-kva size, are located at centers of utilization to supply voltages below the 480-v level. This includes 220-volt service for power tools and 110 volts for lighting circuits.



INTERSECTION of 2500-amp Lo-X feeder busduct and 1000-a plug-in busduct branches is effected through 1000-a circuit breaker cubicle. Note installation details of hangers, sway bracing and angle brackets.

ON the low-voltage side of 4800/480-volt substations, distribution is mainly via 2500-amp low reactive ventilated busduct to 1000-amp circuit breaker cubicles, then via networks of either 1000, 600-, 400, or 225-amp plug-in busduct to all sections of the production area. Direct cable runs extend from substations to such equipments as firepumps, air compressors, battery chargers, hospital X-ray machines, dynamometers and torsion-bar heaters, and to areas devoted to such special operations as welding, spray painting, waste disposal, blue printing and the like.

These direct-connected loads are both sizable and important. For example; to toughen and harden torsion bars requires a 350-kva induction heater and a 280-kw infrared draw furnace. Although each bar is initially heated by induction current for only six minutes, it is raised to 1780 degrees F during this brief period. After quenching in hot oil (kept close to 115 degrees by immersion heating units), bar temperatures are again raised (this time to 800 degrees) in the draw furnace which treats 100 bars at a time. These heating operations play a vital role in making the Bulldog tank the rugged fighting machine that it is, for, after this treatment, bars can withstand operating stresses up to 135,000-psi and can resist twisting to an angle of 82 degrees without failure. Since the torsion bar suspension system has to take the bulk of the punishment as one of these 28-ton giants crashes over rough terrain at speeds up to 40-mph, it can be said that the torsion bar is the heart of a tank—and that electric heat treating puts the heart in the torsion system.

Another concentrated load center is in the all-electric cafeteria kitchen where 4400 meals are prepared each day for Cadillac employees. Here heavy-duty ranges, roasting and bake ovens, broilers, deep fryers and the like are provided to assist the 40-man cafeteria staff. Exhaust hoods and vaporproof lighting fixtures are installed above cooking equipment, continuous-belt dish washers automatically handle that important chore, infrared pass-through food warmers between preparation and serving areas keep hot dishes hot, while similarly-placed refrigerators serve to keep salads crisp and cool.

Powered from the plug-in bus system are approximately 12,000 motors, ranging from fractional to 600-hp synchronous units. All of these motors are maintained on a scheduled basis, and all motors below 125-hp in size are kept in repair by an in-plant motor shop.

The completion of this vast electrical installation months ahead of schedule was due, in no small measure, to the use of modern tools. These aids to construction included hydraulic conduit benders, pipe pushers, jacks for raising and jockeying heavy equipment into position, electric pipe cutting and threading machines, cable pulling winches, hand and power-operated cable pullers, powered band and hack saws, spot-welding units, hydraulic and hand tools for crimping cable lugs, and a variety of electric drills.

...POWER for Tank Production





GUN TURRET assembly, after testing of all electrical and hydraulic components and synchronizing of 76-mm gun with sighting equipment, is lowered into hull by means of remotely-controlled crane.

MAINTENANCE PROGRAM includes periodically reading transmission temperature gauges on load-center substation transformers, then resetting the high-point indicators.

Preventive Maintenance Program

IN this mammoth plant, preventive maintenance is referred to as *productive* maintenance.

The reasoning behind this reference is four-fold. First; G.M's management realizes that maintenance and production are inseparable in our national defense effort. Second; they recognize that maintence *must* be given a position of importance if uninterrupted production is to be obtained. Third; they appreciate the fact that maintenance, in a very tangible way, is an *insurance* policy, guaranteeing the steady flow of Bulldogs from the final assembly line at their Cleveland plant. And fourth; accustomed as they are to measure production in terms of unit costs and daily output, they thoroughly understand that unscheduled shutdowns due to machine failures, resultant lost manhours, wasted materials and lost production dollars more than offset the cost of a *planned* maintenance program.

To keep this huge defense project at peak efficiency, the maintenance department employs 96 men to service all hoists and industrial trucks, scores of electric heating installations, all lighting units, all motors and components of the vast electric distribution system itself which cascades through 5 voltage levels from 132-kv to 110 volt, includes 19 load centers, has 8 miles of busduct and embodies enough equipment to serve a city.

As to organizational structure, the maintenance electrical department is headed by a general foreman who directs the activities of six line foremen, 88 electricians and several trainees who are following a planned 4-year maintenance course.

Direct responsibility for the operation and maintenance of all electrical equipment centers around the general foreman. Also he has responsibility for maintaining spare parts and materials in adequate supply and engineering system changes. To accomplish these major objectives he personally directs his line foremen in their installation, servicing and repair planning. He coordinates all electrical activities within his department. He correlates these activities to those of other departments so that changes in work schedules or electrical service requirements will not result in slow-downs or production interruptions. He acts as liaison between engineering and department heads concerning changes in electrical plans and regulations. He studies manufacturers' specifications, blueprints and wiring diagrams to keep



HOURLY READINGS are taken of all meters in the primary control room, thereby maintaining close supervision on circuit loadings, voltage and power factor. Abnormal conditions are immediately checked.



DRAW-OUT BREAKERS, easily replaced or exchanged are adjusted in the main primary room. Breakers in the main switching center have ICs of 176,000-kva. Feeder cubicles have separate compartments for breakers, CTs and buses.

informed as to new developments in his field. And he develops and recommends practical operating methods and routine shortcuts to the foremen in his departments.

Line foremen and electricians are variously assigned either to separate areas in the plant or to separate types of equipment. For example; one group takes care of all new construction and alterations of existing circuits and equipment. A second group handles building maintenance, the operation and maintenance of primary and secondary 132,000/4800-volt power and lighting distribution, all utility circuits and electrical work on exteriors. Other groups are responsible for the servicing and repair of productive equipment, repairing motors, cleaning and relamping lighting fixtures and so on.

In selecting men for electrical maintenance work, Cadillac strives to obtain qualified journeymen having at least four years of industrial experience, some technical training and the abilities to read blue prints, interpret basic laws of electricity and relate fundamental theories of ac and dc circuits to industrial applications. This indicates a combination of theoretical and practical know-how. Physical fitness is also a requisite for employment.

In the event that a new man does not have a completely rounded background, the supervisor of his department prescribes special training techniques. This training continues until required proficiencies are developed.

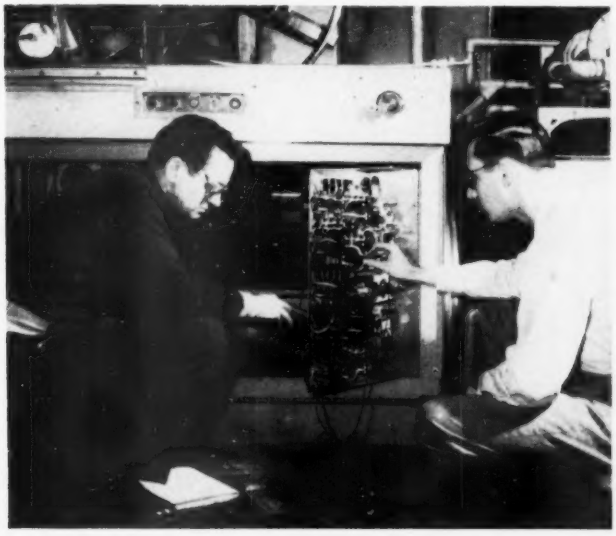
Use of Check Lists

As a further guarantee for intelligent and thorough inspection of equipment, comprehensive maintenance "check-lists" have been prepared for each piece of machinery—from time clocks to 24-foot boring mills. These lists serve as positive checking points for everyone performing inspections, and they are a tremendous asset when assigning route men with limited practical experience to a necessarily wide variety of work. Check lists tabulate all component parts that are to be inspected, and they outline routines for cleaning, adjusting and repair. Minor repairs are completed at the time of the scheduled inspection, while major repairs requiring shutdowns are noted on inspection routing sheets and are *scheduled* so as to minimize interruptions in production.

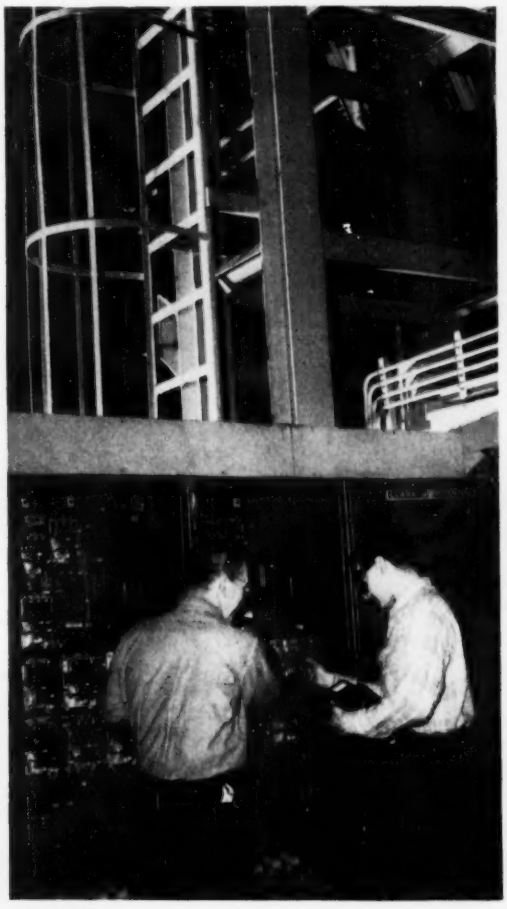
Each maintenance routine has been timed and recorded, so it is possible to plan considered maintenance schedules, thereby fully utilizing the time of each maintenance man without assigning him more than he can efficiently handle.

Analysis of typical inspection routines indicate the thoroughness practiced at Cadillac. For example; in checking transformers, maintenance men (1) check primary and secondary voltages with a voltmeter to see that rated voltages are being delivered, (2) take load tests on the secondary side with an ammeter to prevent equipment overloads, (3) take insulation resistance readings with a Megger to guard against unheralded insulation breakdowns, and (4) check the condition of the oil in all oil-cooled units to see that the oil is clean and its dielectric

...POWER for Tank Production



TROUBLE SHOOTING on this 50-kw 450-kc electronic induction heating machine is double-checked by two electricians who use meters, manufacturer's wiring diagrams and technical data books to analyse existing conditions.



CHECKING, testing and cleaning of all control equipment is performed as a scheduled maintenance routine. Comprehensive "check lists" for each piece of equipment insure that all potential trouble sources are positively inspected.



CONTROLS for furnaces are also regularly maintained by the electrical department. Note that maintenance men wear protective goggles at all times while working in the production section of the plant.

strength is being maintained. (5) Oil level and temperature gauges are checked to see that the unit is properly cooled. (6) All connections are inspected to guard against poor contact due to vibration, heat or mechanical or electrical stresses. And (7) all equipment and system *grounding* connections are checked to preclude loosening by vibration or corrosion.

By following step-by-step check-lists such as this, the operation ceases to be a routine visual inspection and, rather, becomes a thorough observation by competent personnel. The follow-up program, of course, makes sure that any necessary major repairs are completed during scheduled down-time as soon as possible.

Accent on Safety

Through a vigorous safety program, accident frequency has been kept at a commendable level with only two electrical accidents occurring during a 2-year period. This is an average of one accident for each 25,000 man-days of work. But although this record is excellent by *normal* industrial standards, Cadillac believes that those two accidents are two too many, and subsequent analysis has indicated that even these two accidents *could* have been prevented if the workers had followed prescribed safe working habits.

Accent on safety is therefore constantly stressed—by word of mouth, by posters and by rules. All men are provided with safety glasses, and it is a condition of employment that they be *worn*. Rubber gloves and blankets



GROUP REPLACEMENT of fluorescent lamps in 45-foot high-bay areas is performed from an enclosed working cage mounted on a traveling crane. Lighting maintenance is a continuous process requiring full-time service of 4-man crew.

are used whenever the possibility exists of men coming in contact with live circuits, and, during these infrequent occasions, supervisors are *personally* required to be on hand. At all other times, safety rules definitely state that disconnects must be locked opened before any work is performed on a machine or circuit.

In addition, selected personnel have been indoctrinated in First Aid and artificial respiration in the event of shock or injury. Training also has been established to acquaint and train maintenance men in the safe use of ladders and scaffolding. For further safety, all scaffolding is provided with outriggers and guard rails.

By following the motto, "There is no substitute for Safety", all possible hazards have been located and, as far as is humanly possible, eliminated or isolated.

Tools, also, have been recommended or furnished with safety in mind and, as a result, they are of sturdy construction, properly insulated and correctly used. Employees are required to furnish such personal tools as pliers, screw drivers, hammers and hacksaws, but the plant maintenance department supplies such job tools as drills, punches, stocks and dies, hickeys, files, fuse pullers and the like. Also on hand within the department are meters for testing, and such shop tools as power threading machines power hack saws, coil winding machines and benders.



INDUCTION MOTOR is rewound by plant maintenance worker. Present trend is to standardize motor capacities, makes, types and characteristics in order to reduce number of spare units and permit greater maintenance proficiency.

Of the 12,000 motors in the Cadillac Tank plant, many are veterans of World War II days when desired makes and sizes frequently had to be compromised due to non-availability. As a result, a wide variety of motors had been initially installed and, to guarantee continuity of operation, it was essential that a comprehensive assortment of replacement or stand-by units be kept on hand. This tied up both storage space and inventory investment so, at present, a concerted effort is being made to standardize types, makes, capacities and characteristics. This will minimize the number of spare units required to insure production. It will also minimize required storage space and permit maintenance and repair men to become

...POWER for Tank Production



GROWLER CHECK on this dc armature is performed after rewinding. Motor repair shop is equipped with modern facilities for stripping, rewinding, dipping, baking, etc.



HYDRAULIC CONDUIT BENDER is used during installation of new circuit. Other tools on the job include jacks for heavy lifting, electric pipe cutters and threaders.

more proficient in servicing these units.

Motors are cataloged on IBM file cards that list the location, function, hp, frame, rpm and other pertinent data for each motor. In addition, the card pertaining to each critical machine is cross-referenced to its related case history, blueprint and operating sequence. This information is filed by departments in order to facilitate rapid checking. In addition, all machinery repair charges are recorded individually and reviewed monthly to detect any unusual or recurrent breakdowns, and to formulate cost records.

During inspections, special attention is directed to motor cleanliness, accumulations of dirt or dust in windings, or particles of metal or other destructive agents being present. Motors are blown out by compressed air.

Oil and grease also receives attention, making sure that sufficient quantities are present in the *right places* and are absent from windings and similar locations where their presence would be deleterious.

Attention is likewise directed to commutators and rings, brushes, windings, connections, mechanical parts and starting equipment.

When an inspection reveals that a motor is running hot and there is a possibility of it burning out before a scheduled shutdown can be arranged, a spare unit is called for and promptly brought up as an emergency stand-by. Therefore, if actual failure occurs during a production cycle, the transfer over to the new unit can be made with minimum delay. If the hot motor lasts until a quieter shift, however, it is replaced at that time, then taken to the plant motor repair shop where trained workers can completely recondition any unit in the factory, from fractional units to 100-hp motors or 100-kva transformers. This reconditioning service includes not only bearings, brushes, shafts and the like, but coil rewinding as well.

Possible advantages to be obtained by sending some of this work to outside repair shops have been weighed on numerous occasions. However, in view of the fact that minimum *down time* is the governing factor and since in-plant motor reconditioning has reduced out-of-service periods from a matter of weeks to that of days or hours on numerous occasions, it is the policy at Cadillac to handle all motor repairs in their own maintenance shop.

Group Lamp Replacement

It is recognized by Cadillac that a lighting system is a good investment only when it delivers the quantity and quality of light for which it was designed. G.M. management also appreciates the fact that good lighting pays dividends in increased efficiency, lower operating costs, higher employee morale and fewer accidents. For these reasons the *causes* for lost light are minimized as much as possible.

Knowing that the wisdom of burning a lamp until it fails has long since been de-bunked, scheduled group replacement is practiced. In this way normal production routines are not disturbed and routine cleaning, relamping and testing is performed during all shifts. Fluorescent and incandescent lamps alike are scheduled for replacement in accordance with their life expectancies and, as a result, footcandle intensities are kept high, and blinking, darkening, snaking and discoloring is almost completely absent.

Using special working platforms on top of traveling cranes, rolling scaffolds or ladders for the purpose, 2-man teams clean lamps and fixtures with plenty of water and a good detergent. During these cleaning cycles the men also check for bad ballasts.

These service procedures tangibly prove G.M.'s sincere belief that *no* plant—regardless of size—can afford *not* to have a preventive maintenance program. They appreciate that maintenance costs money, but not early as much as neglect, breakdowns, excessive deterioration and delays caused by improperly-maintained equipment.

The answer is apparent, and is effectively voiced in this Cleveland Tank plant through the mediums of scheduled inspections, planned shutdowns, accurate records, adequate inventories of replacement parts availability of proper tools and instruments, and trained personnel.



ESTIMATING SCHOOL draws contractor "students" from surrounding area during Winona sessions.

Minnesota's

Traveling Estimating School

• • • • brings technical and business fundamentals to electrical contractors throughout the state. University and Industry personnel comprise the faculty.

LIKE many other electrical contractor organizations, the Minnesota Electrical Association, Inc., Minneapolis, wanted to give its members an opportunity to brush up on the fundamentals of operating an electrical construction business. However, establishing a school for this purpose posed a serious problem. Members were scattered throughout the state and it was impractical for them to travel long distances to a central location for an extended course.

Association officers and manager Sheldon H. Beanblossom decided to bring the school to the students if the students couldn't come to the school. With this new approach in mind, they took their problem to the University of Minnesota's Center for Continuation Study. Such a program could definitely be arranged, agreed Dean J. M. Nolte of the University Extension division and Merril K. Cragun, course coordinator of the Center for Continuation Study. Following a planning conference between Association officers and University personnel, a curriculum was established, and school locations chosen and dates set. Prominent industry participants and university instructors were chosen as a faculty. The entire operation was designed to be self-supporting with registration fees covering all costs.

This was the birth of Minnesota's Traveling Electrical Estimating School. It is held in strategically located cities within easy reach of area contractors. Classrooms are meeting rooms in the local hotel. Student groups are comprised of member and non-member contractors and their employees. The two-day lecture and discussion course covers such subjects as estimating fundamentals and procedure; engineering and installation techniques; selling and business promotion; cost and business accounting procedures; electrical inspection and the National Electrical Code in relation to estimating; trends in lighting practice and cost comparisons; credit control and collections; tax procedures and problems; insurance problems.

The first two schools were held in October and December at Duluth and Mankato respectively. Winona was the scene of the third school in February. The last of this initial series will be held in Moorehead in May.

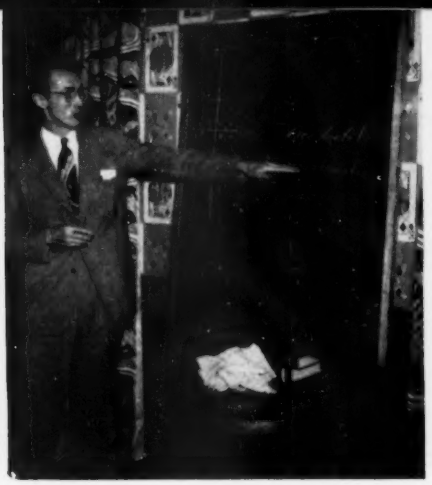
The following photographic sequence of the Winona school "in action" typifies those held in other cities. Although the student body in each area differs, the curriculum and faculty are essentially the same. The professional talent of the "faculty"; the attentiveness of the class; and the eager response with questions and floor discussion are all measures of the interest and success attained by this school.

Both faculty and students appeared encouraged and pleased with the results of this somewhat experimental venture. To supplement the specific technical phases of their operations, contractors gained a broad insight into the complex problems involved in a successful business enterprise. They absorbed much information and made ample notes for future study, reference and application. What they learned should be reflected in the future conduct of their individual businesses.

Because of the broad scope of subject matter covered, this first estimating school was, of necessity, a lecture course. Should the Association decide to continue this activity next year, the number of subjects will be narrowed down and "working" sessions will become part of the course.



COPIOUS NOTES for future study and reference are made during lectures by David Christensen, Austin Electric Service, Inc., Austin, Minnesota.



JESSE FANT, U. of M. instructor of Civil engineering explores the range of error in estimating construction work, discusses basic engineering facts in estimating.



FLOOR DISCUSSION of estimating problems related to inadequate plans and specifications brings Elroy A. Lehn of Anoka to his feet.

ESTIMATING SCHOOL FACULTY

University of Minnesota Personnel

J. M. Nolte—*Dean, University Extension*

Fred E. Berger—*Acting Director, Center for Continuation Study*

Merril K. Cragun—*Course Coordinator, Center for Continuation Study*

William A. Porter—*Program Director, Center for Continuation Study*

Jesse Fant—*Instructor, Civil Engineering*

Roger C. Perry—*Instructor, School of Journalism*

Industry Personnel

Ray F. Braun—*Executive Secretary, Minnesota State Board of Electricity, St. Paul*

Ed Karst—*Electrical Contractor, Fergus Falls*

Al M. Kohler—*Electrical Contractor, Hibbing (President, Minnesota Electrical Association)*

Lawrence E. Johnson—*Illum. Eng., Northern States Power Co., Minneapolis*

W. G. Ochs—*Minnesota Electrical Association Insurance Representative*

E. E. Ranta—*Tax Attorney, Minneapolis*

Clare Rotzel—*Certified Public Accountant; Professor Emeritus, University of Minnesota General Extension Division*

Glenn Rowell—*Elec. Eng., Fire Underwriters Inspection Bureau, Minneapolis*

Sheldon H. Beanblossom—*Manager, Minnesota Electrical Association, Inc., Minneapolis*

Gordon Tucker—*Manager, Midwest Electrical Council, Inc., Minneapolis*



BE SURE TO CHECK your estimate and include all job costs, contractor Ed Karst of Fergus Falls cautions the class during discussion of profitable points in estimating.

INDIVIDUAL ATTENTION during session break is given contractors Gene Burton, Brainerd, and Howard Wolff, Redwood Falls by Clare Rotzel (right), Certified Public Accountant.

DIRECTING SCHOOL operation are Dean J. M. Nolte (left), University of Minnesota Extension division and Merril K. Cragun, course coordinator of the University Center for Continuation Study.

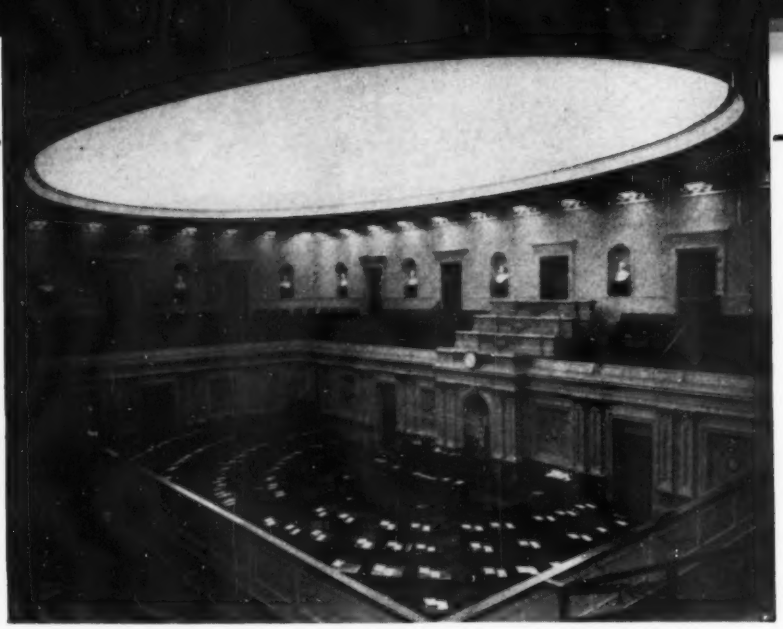
CONTRACTOR AL KOHLER of Hibbing demonstrates how a neat job file folder with complete estimate and pertinent correspondence can minimize error and confusion.







Some practical suggestions for the design of better cove lighting systems, including a round-up of available types of equipment and how to use them.



COVE LIGHTING provides light for Congress in both House and Senate Chambers, U. S. Capitol Building, Washington, D. C. The Senate Chamber is shown here.

Cove Lighting Techniques

By Berlon C. Cooper

COVE lighting is generally considered, and is, an inefficient method of lighting. Yet, in spite of this, it is widely used in all types of lighting applications. These range from small to large interiors, from public to semi-public, to private buildings. Interiors which have been and may be effectively cove lighted include: theatres, restaurants, night clubs, auditoriums, lodge rooms, churches, lounges, ballrooms, reception rooms, dining rooms, foyers, lobbies, stores, small private offices, and many others.

Fundamentally, cove lighting is the uniform illumination of a fairly large ceiling (or other) area from light sources concealed by an architectural element of the interior design, such as a cornice, molding, set-back, or cove. Thus, cove lighting subtly and effectively expresses the intimate relationship between light and architecture. It provides the architect or lighting designer with a most versatile medium for creating patterns of light and shade integrated with the building structure itself. These need not be limited to the ceiling. Useful adaptations of cove lighting permit interesting and ingenious variations, including the reverse cove, multiple coves, inverted cove, suspended ceiling, column and panel coves, and decorative coves for color lighting and spectacular lighting effects. The range of possible cove lighting applications is virtually unlimited for the imaginative architect, creative designer, or lighting consultant who is sufficiently familiar with the engineering and decorative aspects of cove lighting design.

Over the past 40 years or so, since the first use was made of the electric lamp in what is now known as cove lighting, comparatively little in the way of technical and design data on cove lighting has been published, or made available for the guidance of architects and designers. This accounts to a great extent for the lack of perfection which exists in the majority of cove lighting installations now in use. While some departure from perfection in the smoothly lighted appearance of cove lighted areas may be tolerated, such imperfections can in most cases be eliminated, and in all cases greatly reduced. Improved design and appearance is merely a matter of knowing the fundamental principles of light control involved in cove lighting techniques, and applying them with as little deviation and variation as structural conditions will permit. In most instances, where the structural conditions will not permit the application of reasonably sound cove lighting techniques, and these structural conditions cannot be suitably altered, it will generally be advantageous and desirable to adopt some other type of lighting system.

Decorative Cove Lighting

In general, the primary purpose of cove lighting is to provide low level illumination in combination with an interior decorative treatment. It is the most subtle form of indirect lighting, and lends itself readily to use as a cheerful and vibrant form of decoration. Its use is not recommended where illumination levels much in excess of 30 footcandles are required. For strictly utilitarian use, cove lighting is not economical. But where its use can be adapted to serve as a decorative medium, as well as to provide useful illumination, its higher cost can be fully justified. Its inherent refinement is often justification for its use alone, such as in a smart specialty store, an office building lobby, reception room, conference or board room.

Use of white light only in coves can

CHART I - SPECIAL COVE LIGHTING APPLICATION USING PRISMATIC GLASS LENSES

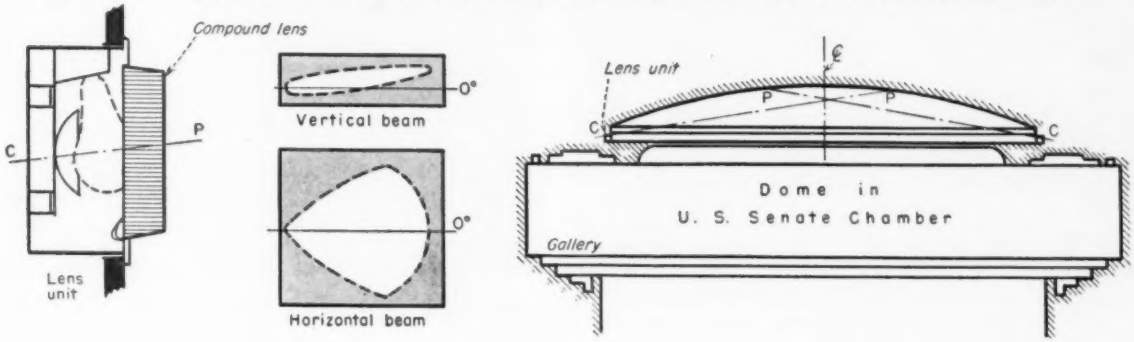


CHART II - PRINCIPLES OF COVE LIGHTING DESIGN USING INCANDESCENT LIGHT SOURCES

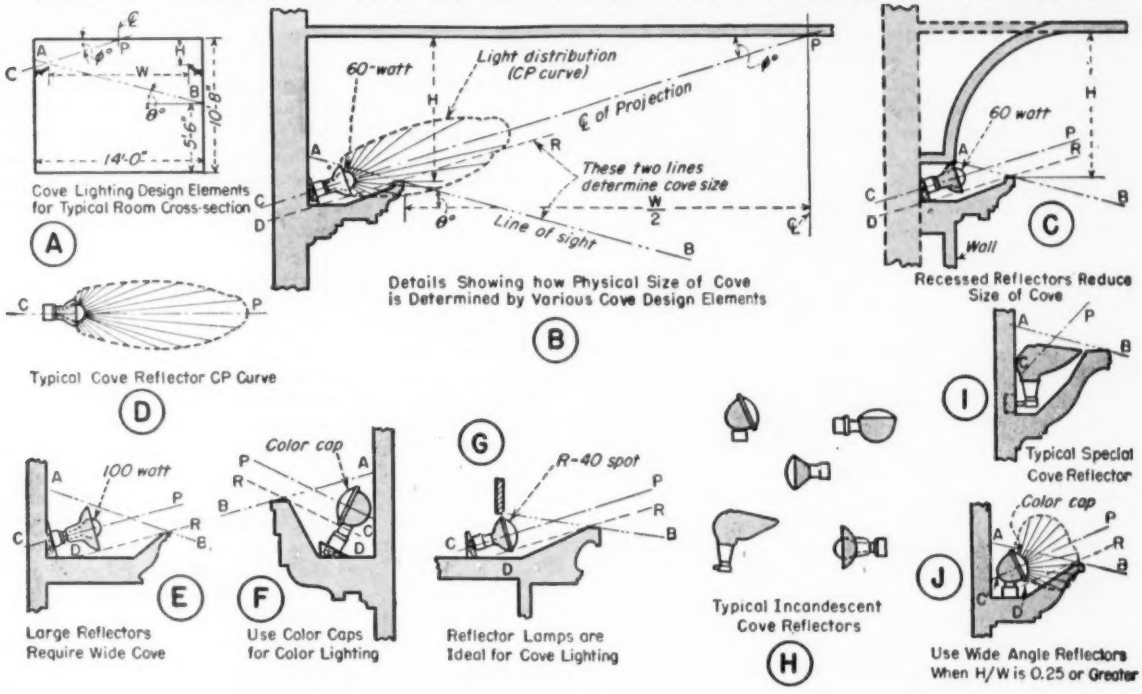
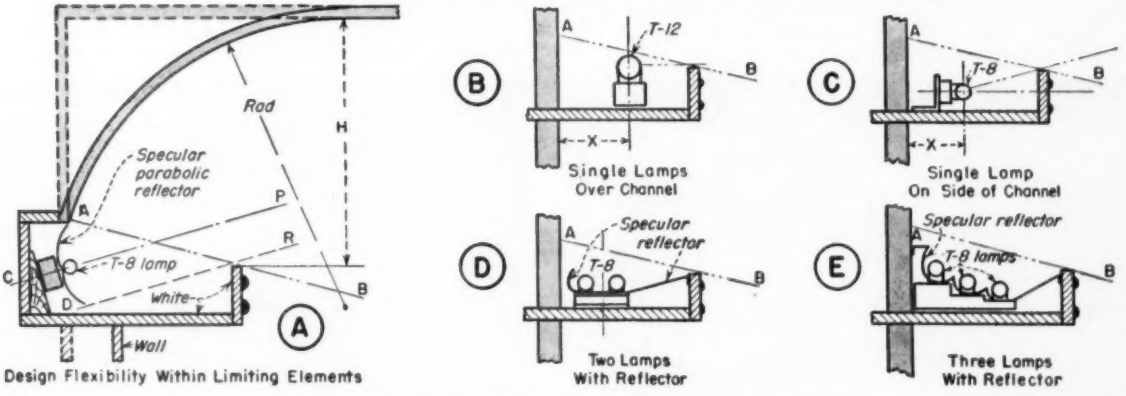
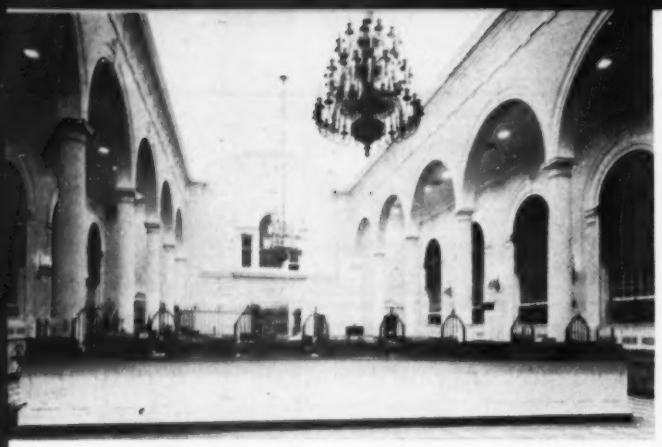


CHART III - FLUORESCENT LAMPS IN COVE LIGHTING DESIGN





ARCHED COVE in bank is evenly lighted to accent height of ceiling. Height of center of arch above coves permits ceiling to be lighted evenly.



COLD CATHODE TUBING in three continuous rows in shallow coves lights ceiling over public area in this bank. A higher arched ceiling would have improved this installation.

be made to conform with decorative effects, and dimmers can be used to obtain variable brightness patterns. Coves recessed in the ceiling can be used to create domes, squares, rectangles, ovals, and other shapes and patterns of light which conform with other architectural details.

The most common type of cove lighting is that in which the entire ceiling, or at least a large central part of it, is flooded with evenly distributed light from equipment concealed by a cove which encircles the room (or large central part of the ceiling), or bounds it on two opposite sides of the upper wall. Where white lighting only is required, variations in intensity can be made by providing for switch control of alternate reflectors or lamps, or by use of dimmers. In general, the dimmers are preferred, since they provide for wide variations in intensity, and eliminate the possibility of shadow effects on the side walls or near the coves.

The use of two or three colors in a cove lighting system, each controlled separately by its own dimmer equipment, makes possible unlimited spectacular decorative effects. Illuminated areas can be applied to wall panels, colums, and ceilings alike, and a wide range of decorative effects can be provided to suit varying moods or uses of the room, by the simple operation of the dimmers. When desired, mobile color effects can be applied simply and automatically through the use of motor-operated dimmers.

Design Elements

Shown in sketches in the accompanying illustrations are the principal elements of cove lighting design. Sketch A in Chart II shows these elements for a typical room 14 feet wide with a 10-ft. 8 in. ceiling height. It is assumed that the top of the cove will be installed 24 inches from the ceiling (H), and that the cove will extend out about 10 inches. Structural conditions and decorative design will establish these details on most installations.

The first cove design element to establish is the line of sight (line A-B). From the point B, which is established at 5-ft. 6-in. from the floor (eye level), a line is drawn across the top of the cove on the opposite side of the room, to point A. The angle θ between this line and the horizontal is thus established, and may be used thereafter in making the detail drawing of the cove. The longest dimension in a room from which the cove can be viewed should be used to establish this angle, and all equipment in the cove should be concealed below this line.

The next element to establish is the centerline of projection of the cove reflector (line C-P), which is done by drawing the line from the center of the cove interior (point C) to the centerline of the room (point P). The point P should always be at the center of the ceiling area to be lighted, or beyond, up to two-thirds the width of this area. The angle ϕ between this line and the ceiling is thus established, and may be used thereafter in detailing the cove.

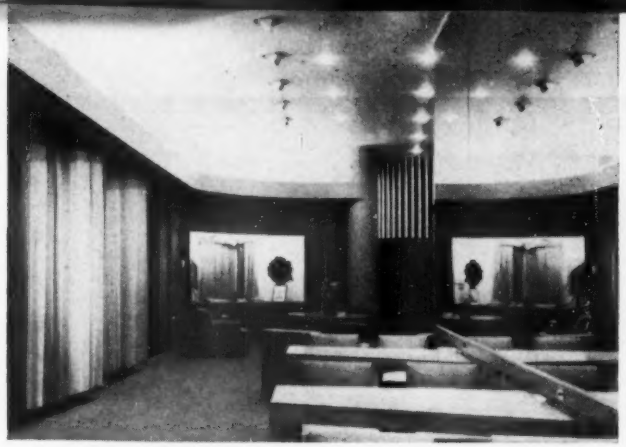
The distance from the ceiling to the top of the cove is labeled "H", and the width between the coves is labeled "W". For satisfactory lighting results, the ratio of H/W should not be less than .15 when highly concentrating

TWO-LAMP STRIP in cove around entire room provides comfortable lighting, but fails to do satisfactory job due to cove being too close to ceiling.



BRACKET TYPE COVE installed 30 inches from ceiling is improvement over cove job at left. Use of concentrated reflector in bracket would eliminate dark area in ceiling.





FLUORESCENT COVE lighting in narrow men's store provides nearly uniform lighting on ceiling to relieve contrast of recessed downlights.



COVE NEAR CEILING in wide store creates sharp contrast between bright ceiling and wall at cove and dark ceiling in center of room.

reflectors are used, and not less than .25 when wide angle reflectors (or bare fluorescent lamps) are used. Higher values of H/W are always desirable, and smaller values will result in an unevenness of brightness great enough to be disturbing. An exception may be made, however, if the center area of the ceiling can be lighted from a floor pedestal, top of a floor case, or by other similar means.

With these design elements established, it is now possible to proceed with the selection of the proper lamp size, type of reflector and the detail design of the cove.

Using Table I the coefficient of utilization for the room under consideration is estimated, and the total lumens required to produce the illumination level desired are obtained by using the standard lumen method formula for lighting calculations. The total cove length is then used to determine the lumens per foot of cove required. Once the required lumens per foot are known, the next problem is to select a lamp size which will provide the necessary lumens per foot and at the same time provide a lamp spacing which will be satisfactory—not too close to preclude the use of a suitable reflector, and not too wide so that an uneven lighting effect will occur on the wall above the cove. This is done by trial and error.

Sketch B in Chart II shows how the line of sight (line A-B), the angle of projection (line C-P), and the reflector (Sketch D) are used to determine the physical size of the cove. First, a suitable 60-watt reflector having a concentrated light distribution, such as is shown in Sketch D, is selected. The reflector cross-section should be drawn to a suitable scale, usually one-fourth full size. The same scale should be used for the reflector that is to be used in making the cove detail. The candlepower distribution curve for the reflector should also be indicated on the reflector drawing.

In detailing the cove, the wall line and a horizontal line through the top of the outer edge of the cove should be drawn. The scale drawing of the reflector is then placed beneath the tracing so that its axis, CP, parallels the angle of projection. Maintaining this angle, the reflector is positioned so that it will fall below the intersection of the line of sight and a line DR drawn through the lower edge of the reflector parallel to the angle of projection, line CP. Where the line of sight and line DR crosses the horizontal line used to establish the location of the top of the cove from the ceiling, is the outer edge of the top of the cove. The cove interior is then constructed so that it will accommodate the re-

(*Continued on page 256*)

TABLE I—Coefficients of Utilization for Cove Lighting*

RF of Ceiling RF of Walls	75% 50%	50% 30%
RI—A	.37	.23
RI—D	.33	.19
RI—G	.21	.11
RI—J	.10	.05

*Average valves, with average conditions and good relationship of cove to ceiling. Increase values up to 20% for good conditions, and when reflectors are used Decrease values up to 20% for poor conditions, such as cove too close to ceiling, and use of bare fluorescent lamps in small coves.

POOR COVE DESIGN results in dark panel in cove ceiling due to insufficient height of ceiling above coves for width between coves. Concentrated type reflector would also improve job.



REVERSE COVE is used in shoe store to light side walls, create decorative atmosphere. Light floor reflects light to center ceiling area.





BANK OF FOUR 120-kvar Westinghouse capacitors raised plant power factor from below 70 to above 98 percent. Installed over a week-end, the job did not interfere with normal round-the-clock operation. G. E. Sears, shell division manager, supervised installation by plant maintenance crew.

CAPACITORS PAY FOR THEMSELVES

WHEN an industrial plant suddenly increases the number of its electrically powered machines by 250%, multiplies its connected load by 9, then switches from single-shift to round-the-clock operation, its distribution system receives a jolt and utility demand charges skyrocket.

That was the case when Lempco Products of Maple Heights, Ohio, signed up to produce mortar shells for the Korean scrap. The number of their motorized machines went from 72 to 257, connected load climbed from 500 to 4800 horsepower and, as indicated in Table I, their demands zoomed upwards from below 130 to over 1550 kilowatts.

To handle this sizable jump, Lempco materially expanded their transformer capacity, increased the sizes of main feeders, installed a system of plug-in and trolley duct. Yet all this failed to solve their problems, for voltage drop adversely affected the efficiency of motor and lighting operation, and power factor dropped beneath 70%.

G. E. Sears, manager of Lempco's shell division, discussed the situation with the local utility's industrial engineer, Frank Detwiler, who first surveyed the plant, analyzed the loading and positioning of equipment, then came up with the recommendation to install four 120-kvar Westinghouse capacitors. Since one similar unit was already in operation, this amounted to a total of 600-kvar reactive capacitance to supply magnetizing current required to serve the plant's many inductive devices.

The installation was promptly made and instantly justified, for the power factor went up as high as 98.9%, volt-

BEFORE AND AFTER COMPARISON TABLE

	Actual Plant Demand (kw)	*Power Factor %*	*Reduction in Billing Demand (kw)*	*Savings in Demand Charges ($)*
Year	129.6	98.3		
Prior	144.0	93.4		
to	153.6	91.9		
Capacitor	165.6	90.4		
Installation	204.0	75.5		
	300.0	71.4		
	384.0	64.9		
	528.0	67.6		
	600.0	70.7		
	684.0	70.7		
	744.0	71.5		
	756.0	73.1		
Year	858.0	93.0	256	320.00
Following	888.0	98.9	317	396.25
Installation	944.0	98.4	335	418.75
of four	1056.0	98.1	364	455.00
120-kvar	1136.0	98.7	402	502.50
Capacitors*	1088.0	98.2	379	473.75
	1152.0	97.5	396	495.00
	1216.0	95.7	400	500.00
	1304.0	95.1	425	531.25
	1552.0	93.9	486	607.50
	1488.0	93.8	462	577.50
	1416.0	93.1	438	547.50
			4660-kw	$5825.00

*Since one similar unit had been installed more than a year previously the total reactive capacitance in the plant is now 600-kvar.

Bank of wall-mounted capacitors, installed in industrial plant having connected load of 4800-hp and demand of 1550-kw, boosts power factor 28 percent, reduces utility charges $485 monthly and pays for itself from savings in 21 months.

age drop has lessened, motor outputs and footcandle levels improved.

To prevent a major shutdown of production equipment, the installation was planned for a week-end. All panels and brackets were fabricated in advance, tools and accessory fittings were pre-assembled and plant maintenance men (who performed the installation) studied connection diagrams and mounting details prior to the actual work. When all was in readiness, the work got underway on a Saturday noon and was completed by 4 p.m. the following afternoon.

Since capacitors are wall mounted, usable floor space has not been affected. Also, inasmuch as there are no moving parts in the assemblies, maintenance is negligible. Enclosures are dust-tight, constructed of hermetically-sealed zinc-coated sheet steel. Operation is noiseless and depreciation extremely low. The satisfactory operation of the installation is summed up by plant manager Sears who states, "Even our largest 40 hp motors now start up instantly and, with every machine in the shop running, we don't even notice dimming of lights."

As to cost; the capacitors, mounting brackets, associated wiring and labor for the installation approximated $10,000. And subsequent savings in utility charges, due to decreased demand charges, averaged $485 monthly. This indicates that the installation will pay for itself in about 21 months.

Actually, the monthly savings varied from $320 to $607.50, and they totalled $5825 for the first year of service. Since demand charges were obtained by multiplying *billing demand* by $1.25, these dollar savings represent reductions in billing demand of from 256 to 486 kw monthly and an annual reduction of 4660 kw.

Without discussing all of the details of the utility rate structure, the approximate manner by which these billing demands were decreased may be explained by a simple parallel example based on the assumption that *billing* demand is obtained by multiplying *actual* plant demand by the ratio between the utility's established *base* power factor and the plant's *actual* p.f. That is:

Billing kw demand = actual kw demand $\times \frac{\text{base p.f.}}{\text{actual p.f.}}$

If, for illustration purposes, we assume that the utility company's established base power factor is 85% then, when the actual p.f. is likewise 0.35, the billing demand and actual demand will be equal.

Similarly, if the actual p.f. were only 70%, the billing demand would equal the actual demand multiplied by $\frac{0.85}{0.70}$ or 1.214. Then, if the actual p.f. were improved to 95%, the new multiplier would be $\frac{0.85}{0.95}$ or 0.895

In this example, if the actual demand were 1000-kw per month, then the billing demand would be 1214-kw with a 70% power factor, and only 895-kw with a p.f. of 95%. The difference between the two totals (i.e., between 1214 and 895-kw) would be the reduction in billing demand due to the improvement of the actual p.f. in the plant.

While the savings obtained by Lempco Products are relatively larger than those which might be secured in a smaller industrial plant, it should be pointed out *any* plant can justify the installation of capacitors for the purpose of improving power factor. In fact, since smaller plants with relatively smaller electrical loads generally have to contend with higher demand and energy *rates*, their *percentage* of savings would be greater and investment amortized in less time.

For Good Design Use These . . .

Tables of Average Circuit Lengths

. . . when you plan an electrical distribution system. Values are based on one percent voltage drop and copper resistance at "operating" temperatures.

Table of average circuit lengths for 3 and 4 wire balanced 115 v. lighting loads with 1% (1.15 volts) drop from supply cabinet to first outlet supplying permanently connected current consuming appliance or lighting fixture. All conductors grouped in same conduit.

Copper resistance "K" — 13 ohms per CM ft. at 60°C (140°F)

AMPERES (A), WATTS (W), WITH CONDUIT CONDUCTOR (C), FILLS (F)

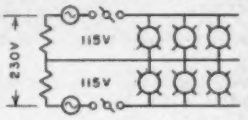
MAXIMUM OVERCURRENT CIRCUIT PROTECTION	INTERMITTENT LOADS			CONTINUOUS LOADS		
	100% F 2-3 C	80% F 4-6 C	70% F 7-9 C	100% F 2-3 C	80% F 4-6 C	70% F 7-9 C
15 A	15 A 1725 W	12 A 1380 W	10.5 A 1207 W	12 A 1380 W	9.6 A 1104 W	8.4 Amps. 966 Watts
20 A	20 A 2300 W	16 A 1840 W	14 A 1610 W	16 A 1840 W	12.8 A 1472 W	11.2 A 1288 W

LOADS AND LENGTHS IN FEET FOR 1% DROP ON 3 AND 4 WIRE 115 V. CIRCUITS

AMPERE LOAD	#10 WIRE	#12 WIRE	#14 WIRE
1	946	596	374
2	474	298	188
3	316	198	124
4	236	148	94
5	190	120	76
6	158	100	62
7	136	86	54
8	118	74	46
9	106	66	42
10	94	60	38
11	86	54	34
12	78	50	32
13	72	46	28
14	68	42	26
15	64	40	24
16	60	38	
17	56	36	
18	52	34	
19	50	32	
20	48	30	
21	46		
22	44		
23	42		
24	40		
25	38		
26	36		
27	36		
28	34		
29	32		
30	32		

On 4-wire, 3-phase "Y" power and light service with 2-ph, 3-wire circuits use ⅔ table circuit lengths for 2-ph circuits when tapped off 4-wire system.

For 2-wire, 115-volt circuits, use one-half table circuit lengths.



Example. 2-Wire, 115-volt, No. 14 wire circuit

$$\text{Length} = \frac{1.15 \text{ (Volt drop)} \times 4107 \text{ (CM of \#14)}}{15 \text{ (Amps.)} \times 2 \times 13 \text{ (ft of wire @ 60°C)}}$$

$$= 12.1 \text{ feet}$$

TABLE I—For lighting loads on balanced 115-volt, 3- and 4-wire systems. See notes and examples for 2-wire circuits.

VOLTAGE drop is a determining factor in the design of any electrical distribution system. Handbook figures show, for example that a 1% drop in voltage reduces the output of lighting units some 3%; a 5% drop causes a 16% reduction; a 10% drop produces a 30% decrease in light output. On power circuits, low voltage seriously affects the starting and pull-out torque of motors as much as 25%. The increased current due to low voltage causes motors to have an above-normal heat rise.

The National Electrical Code contains definite regulations for determination of conductor sizes to serve specific electrical loads. However, code ratings for conductors in the "Allowable Current-Carrying Capacity" tables (Tables 1 and 2) are based only on temperature and do not take voltage drop into consideration. Calculations based on these Carrying-capacity tables are for minimum safety standards and by no means allow for electrical system adequacy and efficiency. Regarding voltage drop, Section 2202 of the NEC states: "The size of feeder conductors should be such that voltage drop up to the final distribution point for the load as computed by Section 2203 will not be more than 3% for power loads, and not more than 1% for lighting loads or combined lighting and power loads." Drop in branch circuits must also be considered in the design.

Good engineering practice requires that total voltage drop on power circuits to motors be held to a maximum of 5%, with 2% allocated to the branch circuit. Because of the more critical situation on lighting and heating circuits, with a 100% steady load, a total of 2% drop is recommended with 1% allocated to branch circuits.

This leaves actual determination of the proper conductor (or wire) size up to the estimator or engineer figuring or designing the system. Knowing the circuit distances required by equipment layout, he can calculate voltage drop from available Handbook formulae, charts and data. From such computations he can determine the proper size conductor to carry "x" amperes "y" feet at a "z" percent voltage drop.

Now those involved and tedious

Table of average circuit lengths for single-phase, A.C., 3-wire (230-115-230 v.), 60 cycle, 100% power factor system. Feeders with 1% (1.15 volts) drop for balanced 3-wire loads. For 2-wire, 230-volt single-phase loads, voltage drop is 2.3 volts. Circuit lengths in feet.

Copper resistance "R"—12.5 ohms per "CM" ft. at 50°C. (122°F.)
Reactance and impedance losses calculated for each wire.
Conductors closely grouped in metallic conduit.

AMPERE LOAD	WIRE SIZE—CIRCULAR MILS					WIRE SIZE—B & S or A.W.G.								
	500	400	350	300	250	4/0	3/0	2/0	1/0	1	2	3	4	6	8
40	1106	898	788	669	558	475	378	299	239	188	150	119	94	59	38
50	885	719	630	535	447	380	303	240	191	150	120	91	75	47	30
60	737	599	525	446	372	317	252	200	159	125	100	79	62	39	
70	632	513	450	382	319	271	216	171	136	107	86	68	53	34	
80	553	449	394	334	279	238	189	150	119	94	75	59	47		
90	491	399	350	297	248	211	168	133	106	83	67	53	42		
100	442	359	315	267	223	190	151	120	95	75	60	47			
110	402	327	286	243	203	173	138	109	87	68	55				
120	369	299	263	223	186	158	126	100	79	63					
130	340	276	242	206	172	146	116	92	73	58					
140	316	257	225	191	159	136	108	86	68						
150	295	240	210	178	149	127	101	80	64						
160	276	225	197	167	140	119	95	75	60						
170	260	211	185	157	131	112	89	70							
180	246	200	175	148	124	106	84	66							
190	233	189	166	140	117	100	80								
200	221	180	157	134	112	95	76								
210	211	171	150	127	106	90									
220	201	163	143	122	101	86									
230	192	156	137	116	97	83									
240	184	150	131	111	93										
250	177	144	126	107	89										
260	170	138	121	103	80										
270	164	133	117	99											
280	158	128	112	96											
290	152	124	109	92											
300	147	120	105												
310	143	116	102												
320	138	112													
330	134	109													
340	130	106													
350	126														
360	123														
370	119														
380	116														

AMPERES PER KW. at 100% to 70% P.F.

POWER FACTOR	1-PHASE	3-PHASE
1.00	4.35	2.51
.95	4.58	2.65
.90	4.83	2.80
.85	5.12	2.96
.80	5.44	3.14
.75	5.80	3.35
.70	6.21	3.59

APPROX. COPPER "R"—OHMS PER "CM" FT.

Temp. °C	Temp. °F	"R"—per CM FT.
20	68	10.4 ohms
25	77	10.8 ohms
30	86	11.0 ohms
40	104	11.5 ohms
50	122	12.5 ohms
60	140	13.0 ohms
75	167	13.6 ohms

FORMULAE FOR AMP. PER KW. AT 100% P.F.

1-PHASE $A = \frac{1\ (KW) \times 1000\ (W)}{230\ (V) \times 1.00\ (P.F.)}$

3-PHASE $A = \frac{1\ (KW) \times 1000\ (W)}{230\ (V) \times 1.00\ (P.F.) \times 1.727}$

Conductivity of Copper

Soft Annealed—all sizes	98.3%
Medium Hard—.32 to .04 Dia.	96.7%
Hard Drawn—.32 to .04 Dia.	96.3%

FORMULAE FOR CALCULATING DISTANCE:

Copper "R" -12.5 ohms/CM ft. at 50°C.
A.C. Distance Formulae give only approximate lengths.

D.C. Distance = $\frac{\text{Volts drop} \times \text{wire size (circular mils)}}{\text{Ampere load} \times 2 \times R\ (\text{Resistance per CM ft.} = 12.5)}$

1-PHASE Distance = $\frac{\text{Volts drop} \times \text{wire size (circular mils)}}{\text{Amps. (at given PF)} \times 2 \times R\ (12.5 + \text{Reactance} + \text{Impedance})}$

For 3-Phase distance on 3-Phase Delta Circuit — use 1-Phase answer $\times .866\ \left(\frac{\sqrt{3}}{2}\right)$

3-Phase Distance = 1.15 x 1-Phase distance, approximately

TABLE II—For single-phase, ac, 115/230-volt, 100 percent power factor system. See notes for 3-phase distance.

Table of average circuit lengths for a three-phase, a.c., 230-volt, 60 cycle, Delta, 85% power factor system. Feeders with 1% (2.3 volts) drop with balanced loads. Circuit lengths in feet.

Copper resistance "R"—12.5 ohms per "CM" ft. at 50°C. (122°F.)
Reactance and impedance losses calculated for each wire.
Conductors closely grouped in metallic conduit.

AMPERE LOAD	WIRE SIZE—CIRCULAR MILS					WIRE SIZE—B & S or A.W.G.								
	500	400	350	300	250	4/0	3/0	2/0	1/0	1	2	3	4	6	8
40	710	625	584	530	475	429	364	303	253	208	173	139	113	75	49
50	568	500	467	424	380	343	291	242	203	167	139	111	90	60	39
60	473	417	389	353	317	286	243	202	169	139	115	93	75	50	
70	406	357	333	303	271	245	208	173	145	119	99	79	64	43	
80	355	312	292	265	238	214	182	151	127	104	87	69	56		
90	316	278	259	235	211	191	162	134	113	92	77	62	45		
100	284	250	233	212	190	172	146	121	101	83	69	55			
110	258	227	212	193	173	156	132	110	92	76	63				
120	237	208	195	177	158	143	121	101	84	69	58				
130	218	192	180	163	146	132	112	93	78	64					
140	203	179	167	151	136	123	104	86	72						
150	189	168	156	141	127	114	97	81	67						
160	177	156	146	132	119	107	91	76							
170	167	147	137	125	112	101	86	71							
180	158	139	130	118	106	95	81	67							
190	149	132	123	112	100	90	77								
200	142	125	117	106	95	86	73								
210	135	119	111	101	90	82									
220	129	114	106	96	86	78									
230	123	109	101	92	83	75									
240	118	104	97	88	79										
250	114	100	93	85	76										
260	109	96	90	81	73										
270	105	93	86	78											
280	101	89	83	76											
290	98	86	80	73											
300	95	83	78												
310	92	81	75												
320	89	78													
330	86	76													
340	83	73													
350	81														
360	79														
370	77														
380	75														

Approx. Resistance—Ohms per "CM" Ft. at Copper Temperatures of 50°C to 75°C.

WIRE SIZE	R @ 50°C	R @ 60°C	R @ 75°C
No. 14 to 6	11.6	12.1	12.7
No. 4 to 1/0	12.0	12.5	13.1
2/0 to 4/0	12.4	12.9	13.5
300 MCM	12.7	13.2	13.8
400 MCM	13.0	13.5	14.2
500 MCM	13.4	13.9	14.6
AVERAGE "R"	12.5	13.0	13.6

NOTES:

For 208-volt, 4-wire, "Y" feeders — multiply table circuit lengths by 90%

For 230 volt, 1-phase feeders—multiply table circuit lengths by 85%

For 460-volt, 3- or 4-wire feeders — multiply table circuit lengths by 2

For 2 percent voltage dop — double 1% table circuit lengths

For 3 percent voltage drop—triple 1% table circuit lengths

For aluminum wire which is same size as copper, use 70% of table circuit lengths; or use circuit length of copper wire which is two sizes smaller than aluminum wire under consideration. (Aluminum wire—ohms per CM ft. @ 60°C is 17)

Example:
A 4/0 aluminum wire with 40-ampere load has a circuit length of 303 ft. same as a 2/0 copper wire in table with a voltage drop of one percent.

TABLE III—For three-phase, ac, 230-volt, delta, 85 percent power factor system. See notes for other voltages.

computations are no longer necessary. Finger-tip answers (wire sizes and circuit lengths) can be found by using the accompanying ready-reference Tables of Average Circuit Lengths published to promote better and more adequate electrical system design. Average values of circuit lengths, *based on a 1% voltage drop*, are listed for numerous conductor sizes at various ampere loads.

To use the tables, find the circuit load in amperes (computed) in the first column of the proper table (for correct system voltage), then go across horizontally until the required circuit length figure appears. The conductor noted at top of this vertical column is the wire size needed to maintain a 1% voltage drop for the desired load. Notes on each table show how to convert the values for different system voltages and voltage-drop percentages.

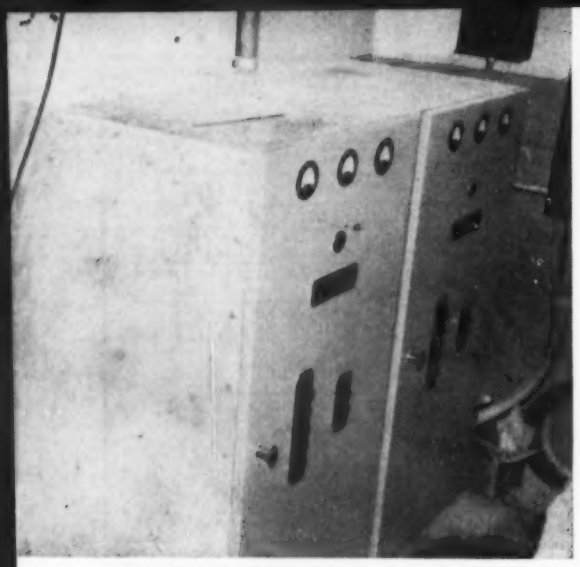
Circuit length values (in feet) were computed on the basis of copper resistance at "operating" temperatures of 50° C (122° F) and 60° C (140° F) as noted. This is in contrast to the normal 10.6 to 10.8 ohms per circular-mil-foot given for copper at 24° C (75° F). Average reactance and impedance losses for each wire at normal power factor have beeen taken into consideration.

Table I covers Lighting Circuits on 3-wire and 4-wire, Balanced 115-Volt Lighting Loads (Branch circuit sizes).

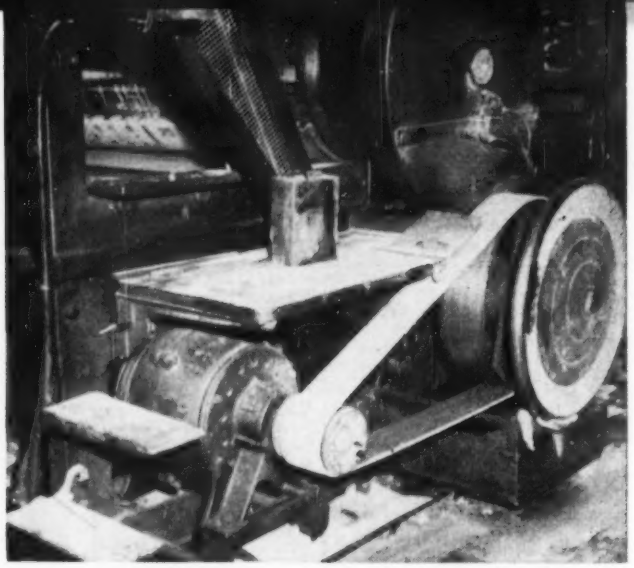
Table II covers Single-Phase, ac, 3-wire, 115/230-volt, 60 cycle, 100% Power Factor Systems (Feeder sizes, usually lighting loads).

Table III covers Three-Phase, ac, 230-volt, 60 cycle, delta, 85% Power Factor Systems (Usually power loads).

These Tables were developed by the electrical contracting industry in Chicago as a contribution to the Chicago Electrical Commission for use in the revision of the Chicago Electrical Code. The Tables have been checked and approved by leading engineers of several large cable manufacturers as *a practical guide for engineers and contractors to check wire sizes.* They can be used with confidence for selecting a wire size that will provide adequate allowance for voltage drop.



MECHANICAL RECTIFIERS, two 20 kw units, occupy little space in the rear corner of a small stock room; are connected in parallel; fed from safety switch.



DC SUPPLY in the printing shop is necessary to power the many dc motors which were installed with the printing presses at the time the building had only dc service.

Powering A Printing Shop with . . .
MECHANICAL RECTIFIERS

The first installation of mechanical rectifiers in New York City now powers a 30 kw load of dc motors at Martin J. Pollak, Inc., Printers and Lithographers. Here's a close look at these new rectifying machines, installed by Mainco Electric Contracting Corp., New York.

By J. F. McPartland, Jr.

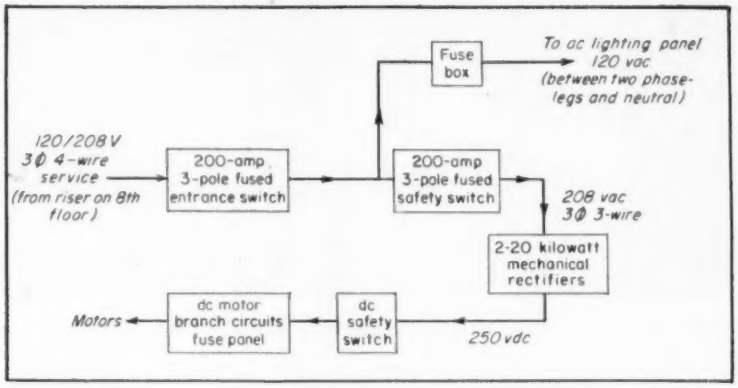
TWO 20 kw mechanical rectifiers now supply dc power for a 30 kw motor load at the printing shop of Martin J. Pollak, Inc., New York City. Offering highly efficient low-voltage power conversion, this installation is the first application of mechanical rectifiers in the city. Inasmuch as the mechanical rectifying machine is relatively new and not common equipment in this country, this installation provides practical background for a study of its application and operation.

Application

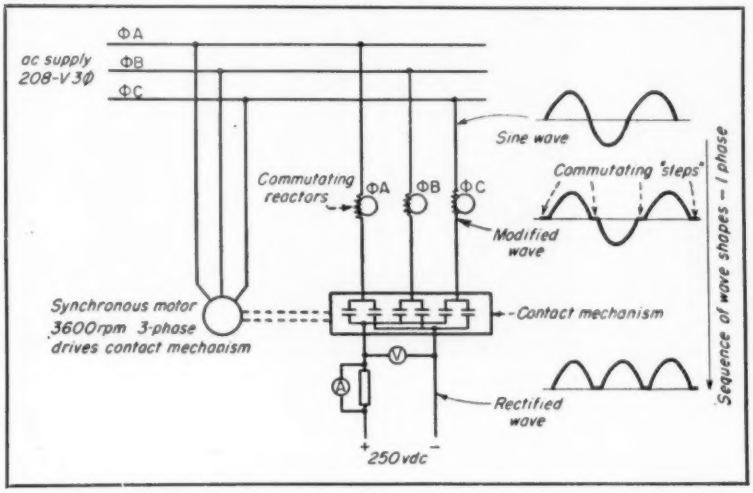
The printing shop is located on the eighth floor of a building in an area which previously had only dc service from the utility. When the utility changed over to ac service to the building, the owners of the print shop were confronted with a not uncommon problem these days: whether to replace all dc equipment with ac types, or to purchase a rectifier supply for the existing equipment. As economy usually dictates in such situations, the problem was resolved in favor of rectifying equipment. On the basis of space available and the requirements of the dc load, mechanical rectifiers were selected for the job.

Wiring design for electrical distribution in the shop is simple and functional. Power is delivered to the premises from a riser in the eighth floor hallway. Service is 120/208 vac, 3-phase, 4-wire through a 200-amp, 3-pole fused entrance switch, with energy consumption metered at this point. From the service entrance, the 4-wire power feed is carried in two-inch conduit through a brick wall into a switch enclosure in a small stock room where the rectifiers are located. The three phase conductors of the feed are connected to the line side of a 3-pole fused safety switch. The neutral of the 4-wire feed and taps off two of the phase conductor terminals on the line side of the switch are run in conduit from the enclosure, through a fuse box, to a lighting panel. All lighting is on ac, with the load balanced between each of the phase feeders and the neutral.

The rectifier cabinets are situated in a rear corner of the small room, each fed at 208 vac, 3-phase, 3-wire from the load side of the safety switch. On the 250 vdc sides, the two rectifiers are connected in parallel. One run of two-inch conduit—from the top of one unit,



BLOCK DIAGRAM of the equipment layout and electric distribution in the printing shop indicates simple and functional wiring design.



OPERATING PRINCIPLES and basic wiring of a mechanical rectifier are illustrated in the above diagrams, showing sequence of wave shapes during rectification.

up to the ceiling and out of the room to a dc panel—carries the positive and negative feeders. From the dc fuse panel, branch circuits are distributed to the various motors operating the printing machines.

Operation

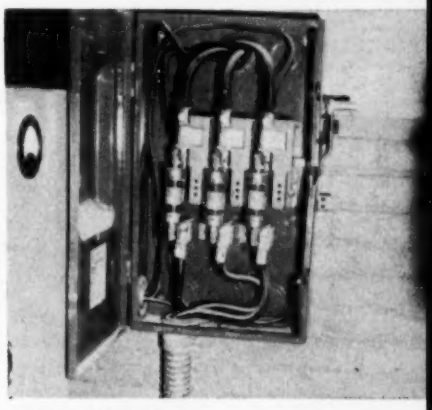
Development of a practical mechanical rectifier was the result of many years of experimenting. Almost from the time ac transmission began, a way was sought to commutate ac by means of synchronously driven contact devices. After many unsuccessful attempts, a practical rectifying machine known as the Contact Converter was finally developed in Germany in 1940. By 1945, the original equipment had been so improved that German industry had many actual installations of mechanical rectifying units. Typical units at that time had ratings of 10,000 amps at 400 volts and 9,000 amps at 180 volts. On the basis of this German experience, mechanical rectifiers were soon developed in this country.

In principle, the operation of a mechanical rectifier involves making and breaking contacts between ac input buses and dc output buses, in such a way that the positive dc bus will conduct only the positive alternations of the ac cycle in each ac bus and the negative dc bus will conduct only the negative alternations. To accomplish this, the contacts must be operated in perfect synchronism and phase relationship with the frequency of the ac supply.

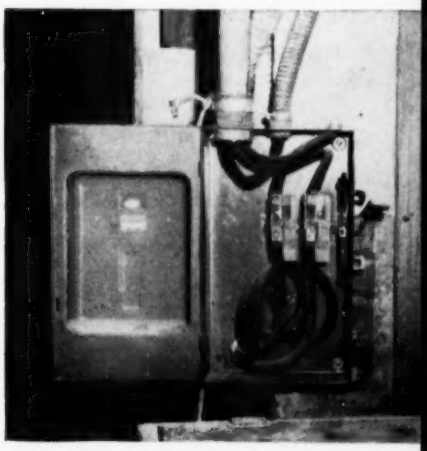
With a 3-phase ac input, full wave rectification is effected as shown in an



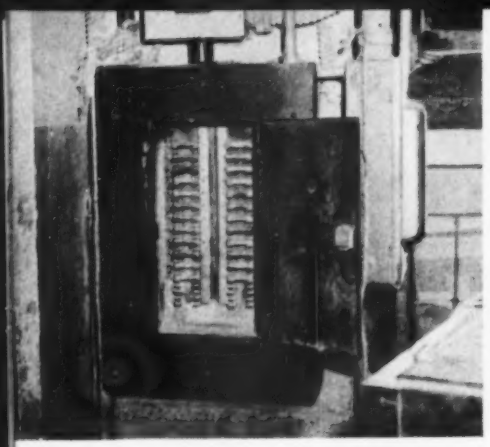
SERVICE ENTRANCE for the shop is located in the eighth floor hallway. 120/208 vac, 3-phase, 4-wire, power is fed from the riser through a 200-amp fused entrance switch.



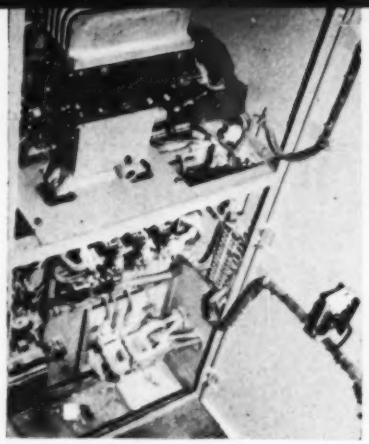
SAFETY SWITCH in small room feeds 208 vac, 3-phase, 3-wire to rectifiers. The neutral conductor and taps off two of the incoming phases are fed to the ac lighting panel from line side of switch.



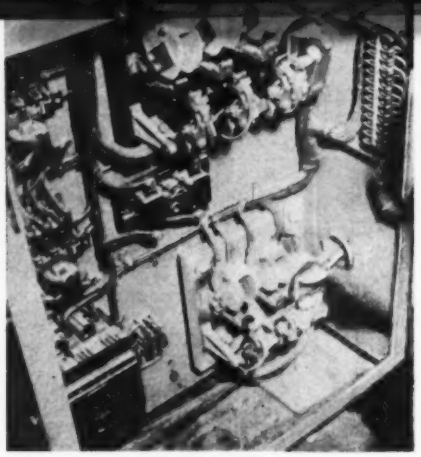
DC FEEDERS from the rectifiers are carried through this safety switch to the dc distribution panel. This switch is located out in the shop and adjacent to the distribution panel.



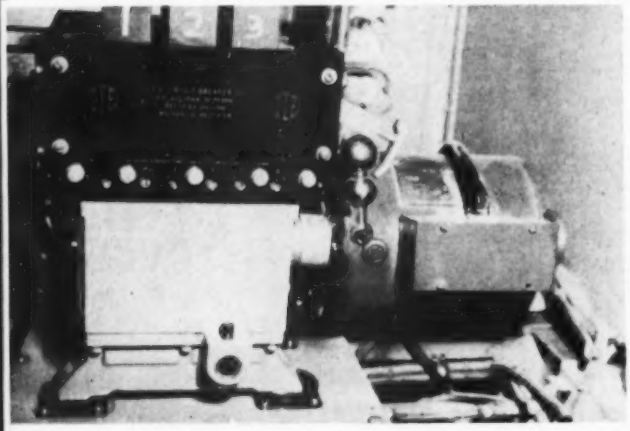
FUSE PANEL from which dc branch circuits are distributed to the various motor locations was used for distribution during the period of dc service to the building.



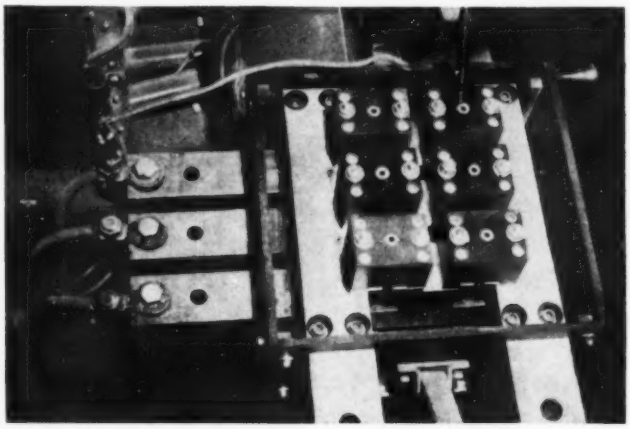
INSIDE VIEW of one of the rectifier units, with door open, shows the contacting mechanism in the upper section and auxiliary controls below.



PROTECTIVE DEVICES in each unit include a 3-pole circuit breaker in the ac feed (top) and a 2-pole contactor in dc output (bottom).



COMMUTATION of the ac supply takes place at the contacts (labelled 1, 2, 3 above) which are actuated by a mechanism in the box below. The mechanism is driven by the synchronous motor at the right.



CONTACTS are mounted on top of lift rods which raise and lower the bridging blocks in such synchronism that the positive and negative alternations of the ac supply (left) are conducted to the respective dc buses (bottom).

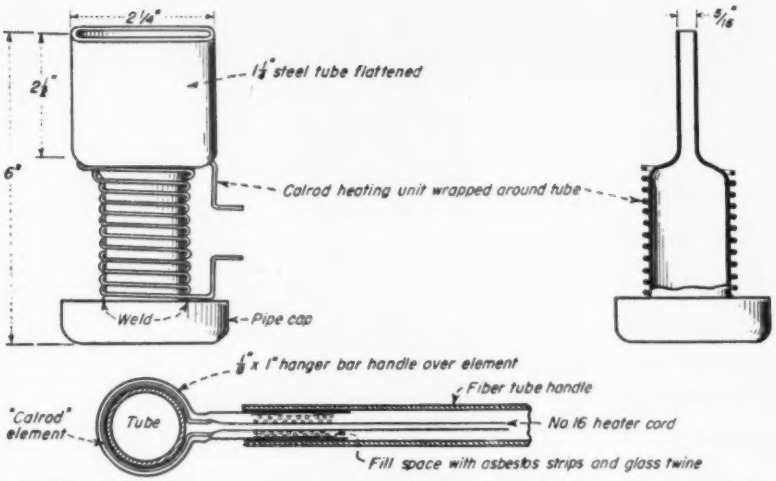
accompanying diagram. Each phase of the input is connected to two sets of contacts, one set for making contact to the positive dc bus on positive alternations of the ac and the other for making contact to the negative dc bus on negative alternations. To assure unidirectional output of proper polarity, operation of the six sets of contacts associated with the three phases of the input is synchronized with the ac input by a contact operating mechanism, driven by a synchronous motor. The contact mechanism consists of eccentrics, levers and lift rods, actuated by rotation of the shaft from the motor. The contacts are opened and closed by the up-and-down movement of the lift rods, similar to operation of valves in an automobile engine. The 3600 rpm, 3-phase motor is in step with, and will follow any changes in, the frequency of the ac supply to the contacts. In this way, rotation of the motor drive shaft, motions of the contact mechanism and operation of the contacts have a physical phase relationship which corresponds to the commutating requirements of the electrical phase sequence of the ac supply. Excitation for the field of the synchronous drive motor is provided through selenium rectifiers.

In addition to the above, there are other factors involved in effective contact conversion of ac power. To eliminate sparking or arcing at opening contacts, the sine wave input to the ac buses must be modified in such a way that there is a short duration of zero current between each successive half wave of the ac. To produce this zero current "step" in the wave, a special commutating reactor, a saturable type, is placed in each phase leg of the input. The synchronized contacts are then made and broken during a zero current duration, with each successive phase connected before the previous phase is disconnected.

Due to the very low contact voltage drop, the mechanical rectifier has inherently high efficiency—as high as 98%—in the 50 to 400 volt range and over a range of loads from 20% to 125% of full load. Voltage regulation of the machine may be accomplished either by regulating the ac supply or by regulating the dc output, by changing the position of the stator of the driving motor.

Reliable and economical operation has been the experience to date with the units at Pollak, Inc. Maintenance has been largely routine inspection of the auxiliary equipment and servicing of the contacts. The contacts and the drive mechanism have required periodic adjustment and some replacement of small parts.

From the experience with this first New York City installation, it seems clear that the long sought contact converter has come into its own. The complete rectifier supply in this printing shop was installed by Mainco Contracting Corp., an affiliate of The Maintenance Company, New York.



DESIGN DETAILS and construction of hand type electric solder pot using Calrod unit as heat source, wrapped around tubular section of pot.



PRE-HEATING A COMMUTATOR with a Calrod heating element (arrow). Unit provides steady, evenly distributed heat for end-ring removal or bar soldering.

Electric Range Units . . .

REDUCE SOLDERING TIME

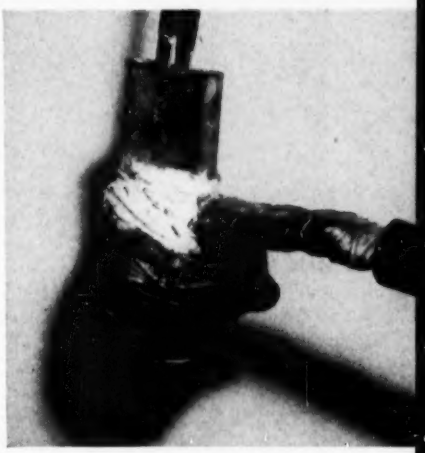
. . . and turn a hot idea into a money-saving shop method at Wm. C. Krauth Electric Company, Louisville, Ky.

MOTOR repair shops have long been known as the birthplace and proving ground for new equipment ideas. Like many other shops, the Wm. C. Krauth Electric Company in Louisville, Ky., is always trying new methods in the continuous battle to lower unit costs and increase shop efficiency to the point where a reasonable profit can be realized for services rendered.

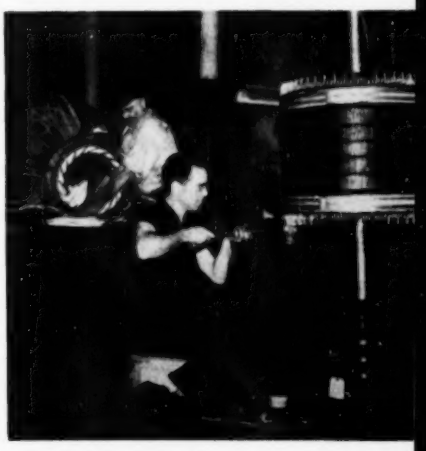
One of the more successful ideas is the use of "Calrod" heating units (electric range type) to cut heating and soldering time on large commutators and armatures. Outstanding example: By wrapping three Calrod units (connected in parallel on 110-volts) around the commutator for pre-heating purposes, a 254-bar commutator was soldered in seven hours with an electric soldering iron. This compared to about twelve hours with iron and torch. Biggest advantage was the continuous, even heat distribution of the units plus the fact that the mechanic was free to do other work during the pre-heat phase. With this method a 25 hp armature can be soldered in two hours, a saving of 50%.

A second application is a hand type electric soldering pot for tinning and soldering coil ends on large armatures or stators. The "pot" is made from a 4½-inch length of 1¼-inch steel tube (thin wall tube) welded to a pipe cap base and flattened at the top to provide a 5/16-in. wide "lip" 2¼ inches long and 2½ inches deep. A Calrod No. WB43X1 unit (about 40 inches long, 500 watt capacity) is wrapped around the tube base and connected to No. 16 heater cord. Two layers of woven asbestos tape and six to eight layers of glass tape form the insulating covering on the pot. The unit is supported by a handle made of ⅛" by 1" hanger bar complete with asbestos and glass insulation and fiber tube cover. The complete unit weighs only a few pounds; is completely portable; and is used only on 110-volt current.

Krauth mechanics can do an exceptionally fine and fast job of tinning coil ends with the hand solder pot; like the steady even heat given by Calrod units on this and the commutator pre-heat application; and use both methods in the shop and in the field.



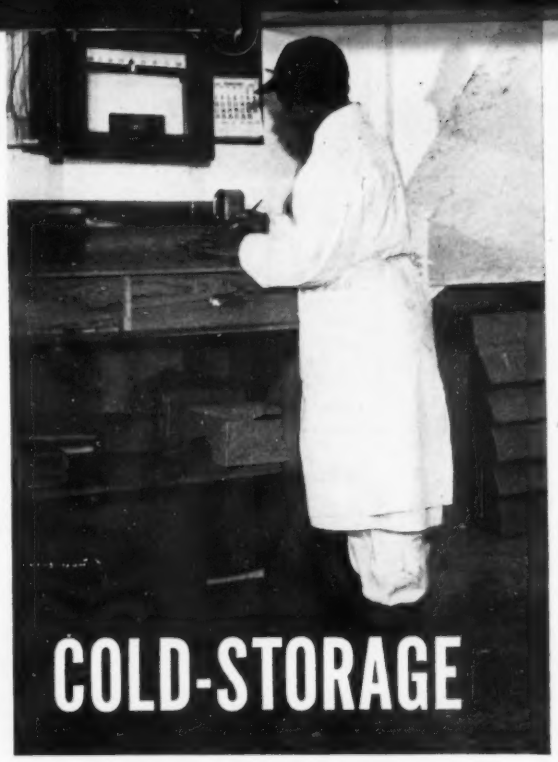
HAND TYPE electric solder pot made with a 500-watt Calrod heating element. Note how coil ends dip into "lip" for efficient tinning.



USING ELECTRIC soldering pot on coil ends of a 150 hp. rotor in the Krauth shop.

Cold storage rooms at Cross Brothers Meat Packing Company, Philadelphia, use electric radiant heating in floors to prevent frost heaving. Thermocouples in floor actuate power control to cables, also recorder for permanent temperature record.

Heating Cables Protect COLD-STORAGE



SUB-FLOOR TEMPERATURES are indicated on control instrument (right) which automatically controls

ELECTRIC heating cables installed in the floors makes it possible to operate ground-level meat storage rooms at sub-zero temperatures, without endangering the floor or foundation of the building, in recently completed expanded storage facilities of Cross Brothers Meat Packing Co., Philadelphia, Pa. This electric radiant heating system prevents frost heaving in the floors, and is controlled by an automatic safety control system. Planned and installed during the early stages of construction, this new system provides extra safety by indicating when the sub-floor temperature drops to an unsafe level, and at the same time, applying heat to increase the temperature.

When Cross Brothers, Pennsylvania's largest wholesale beef company, found it necessary to increase storage facilities in order to handle their large volume of meats for customers and also to handle meat purchased and stored by the U. S. Government, it was decided that the ground floor of their new building would provide the most suitable location. However, this location meant that special precautions would have to be taken to insure the structural safety of the building by protecting the ground floor against frost heaving.

When a freezing room is to be built at ground level, or when a ground level cooler is to be converted for low-temperature storage, it is essential that the insulation be adequate to prevent too-rapid heat leakage into the floor of the room. The recommended construction is a concrete sub-floor, covered by ample insulation, with a concrete-wearing floor on top. This provides mechanical strength, a moisture-vapor-proof insulator, and protection of the insulation. However, even when this recommended construction is used and the thickness of insulation is ample, some heat is absorbed from the ground by the foundation of the cold storage room. When the rate of leakage from the ground to the foundation is higher than the rate at which heat is gained from the surrounding earth, there is a gradual temperature decrease beneath the floor of the cold storage room. When this soil reaches the freezing point, the moisture it contains expands, exerting a tremendous pressure on the floor and foundations of the building. Cracked and buckled floors are common results, and entire buildings have been known to collapse under the strain of a freezing floor.

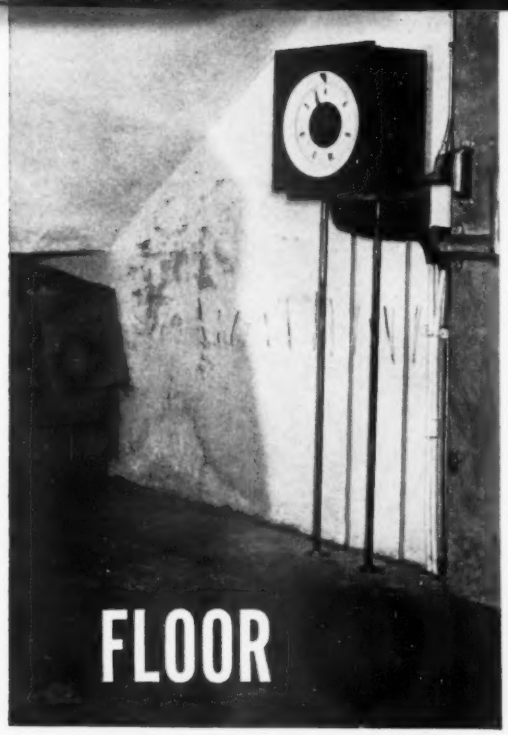
Little Heat Required

With proper insulation and construction, the addition of a very small quantity of heat at periodic intervals is sufficient to maintain the soil which underlies the building at a temperature above the freezing point. When the Cross Brothers cold storage addition was built, it was decided that sub-floor heating should be provided for in order to avoid damage due to frost heavage and to prevent any temporary shutdown which might make it necessary to shift stored meats.

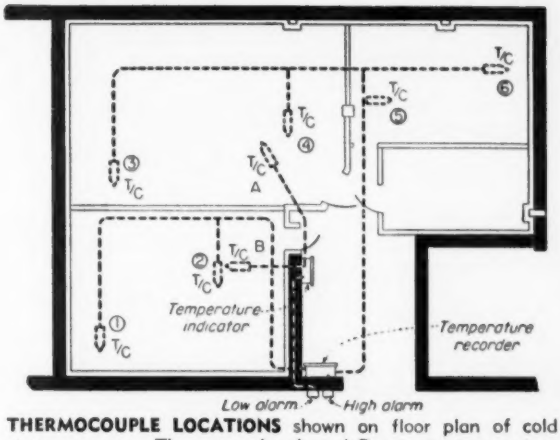
Cross Brothers decided to install electric heating cable in the sub-floor to provide the heat, and to adopt an electronic type of temperature measuring instrument, which would automatically turn on the power to the heating cables when the temperature drops to a critical point. An electronic instrument using a potentiometer-pyrometer was selected, equipped with two temperature-sensitive thermocouples which were located under the floor, with wires leading out for connection to the instrument.

The thermocouples are located just above the coarse aggregate that covers the subsoil on which the cold storage rooms are built. Electric heating cables are also installed in this layer so that heat will be applied directly in the danger area when needed.

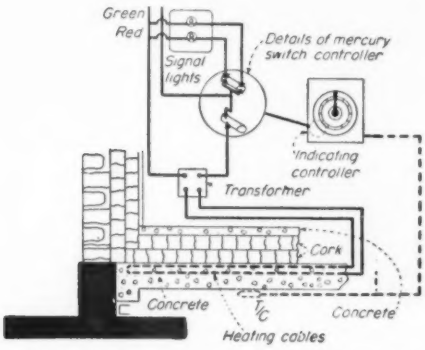
The electronic potentiometer measures and records the sub-floor temperature. It contains an auxiliary switch which will turn on the power to the heating cables when the temperature at the thermocouple location drops below 35°F. The rooms have now been in use for about ten months, at an average temperature of about −15°F, and the sub-floor temperature is still



power to electric heating cables in floor, prevents freezing and damage to floor.



THERMOCOUPLE LOCATIONS shown on floor plan of cold storage rooms. Thermocouples A and B actuate temperature indicating controller which automatically controls power to heating cables, maintains safe floor temperatures.



INSTALLATION DETAILS of heating cables, indicating controller, and location of thermocouple in sub-floor.



INSULATED DOOR, shown open, is closed and locked at night. Red light (left) is visible in corridor, signals when power is on in heating cables.

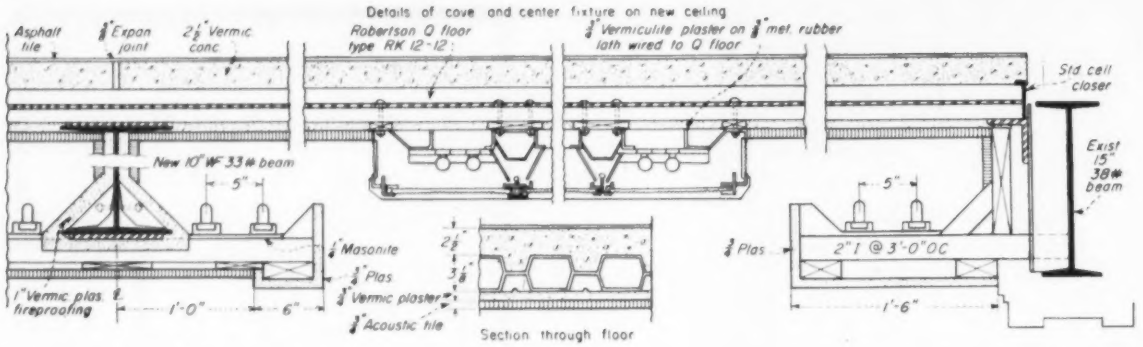
in the neighborhood of 40° due to the absorption of heat from surrounding soil. However, the storage temperature will eventually be dropped to −20°F, at which time the radiant heating system will undoubtedly be needed.

Temperatures at six points throughout the rail storage and boned meat storage rooms are continuously recorded on a multi-point potentiometer. Thermocouples are located at various points throughout the storage rooms, and the instrument automatically scans these points and records the temperatures in sequence. A small + sign is made to show the exact time and temperature for each point, with an identifying number printed beside it. The 30-day chart produced by the instrument satisfied the government's requirements that accurate temperature records be kept.

The multi-point recorder is also equipped with an internal switch which operates a signal light if the temperature in any of the storage rooms should rise above a safe minimum. The signal light is located in a corridor through which the night watchman makes his regular patrols. A red light flashes on if the storage temperature has risen to an unsafe level. The two-light system is used because it would also warn of power failure.

The instrument which controls the electric heating cables is also equipped to operate a separate signal system. This signal light stays green unless the temperature drops to a point slightly below that at which the heating current is to be turned on, and will function as an emergency alarm if the heating system should fail to keep the subfloor temperature at a safe level.

Six circuits of heating cable are used to heat the floors. Each circuit contains approximately 460 feet of cable, which operates at a loading designed to provide 1.35 Btu per square foot per hour. The cable is 18/8, or 18% nickel, 8% chrome type. The installation was made under the supervision of Godwin F. Werling, plant superintendent for Cross Brothers.



SECTIONAL VIEW of new lobby ceiling over former open area showing details of cove and center fixture. Section is at right angles to view shown in photograph.

Modernization brings MORE LIGHT and MORE SPACE

. . . to Walker Bank and Trust Company in Salt Lake City. Low-voltage relay system solves control problem for high-intensity main floor and lobby lighting.



ACCOUNTING DEPARTMENT has 1,400 square feet of additional space created by floor over lobby. Lighting is provided by two continuous rows of 3-lamp fluorescent fixtures suspended from skylight of original two-story lobby.

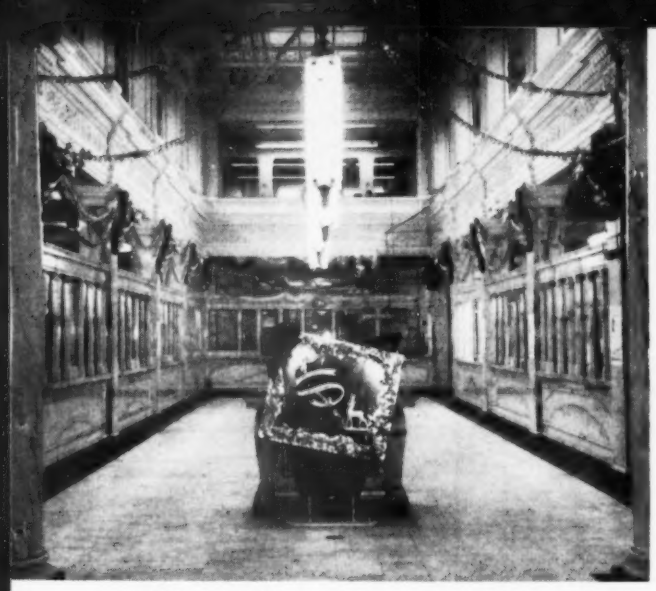
By Ernest Fosberg
Wasatch Electric Company
Salt Lake City, Utah

WHEN the 16-story building of the Walker Bank and Trust Company in Salt Lake City was constructed in 1912, the main banking floor—in line with the current architectural trend—was of the two-story design with a skylight and surrounding mezzanine balcony. In the intervening years, the lighting was modernized to meet current practice but structural features, including the two-story main area, remained the same.

As Walker management expanded banking services and facilities in recent years, the need for more space became evident. Last year a decision was reached to modernize the executive offices and banking areas to obtain optimum utilization of floor space and optimum efficiency of business operation.

To attain this, Architect R. Lloyd Snedaker of Salt Lake City used Robertson Q-floor to enclose the main-floor open area at balcony level. This added approximately 1,400 square feet of floor area to the already crowded accounting department on the second floor. It also required a new lighting system for both second and first floor areas. The former was merely a question of installing good office lighting tailored to the working task at hand. The main floor lighting problem was more complex. Illumination had to be high-intensity and glare-free to minimize the contrast between bright outdoors and the windowless bank interior. Fixture design had to blend with the architectural treatment and preserve the feeling of spaciousness.

Collaborating with Architect Snedaker and bank officials on lighting recommendations were E. N. Christofferson, commercial consultant, Utah Power and Light Co., and C. J. Vacher, lighting specialist, General Electric Supply Co., Salt Lake City. Wasatch Electric Company, project electrical contractor, had the task of renovating the electrical system and installing the lighting.



ORIGINAL LOBBY was of two-story design with a surrounding balcony at second floor level. Illumination at customer level was about 10 footcandles.



NEW LOBBY with open area closed over and distinctive lighting. A glare-free intensity of almost 100 footcandles reduces contrast between bright outdoors and windowless lobby interior.



NEW 40-CIRCUIT PANEL on second floor is dwarfed by massive screw-cover enclosing opening for former twin-panel. Lobby lighting circuits originate here.



LOW-VOLTAGE CONTROL relays and transformer for lobby lighting are installed in partitioned cabinet in base of second-floor column.



MASTER CONTROL switch for new lobby lighting is on wall behind teller's cage. Low-voltage control system permitted use of single existing conduit drop.

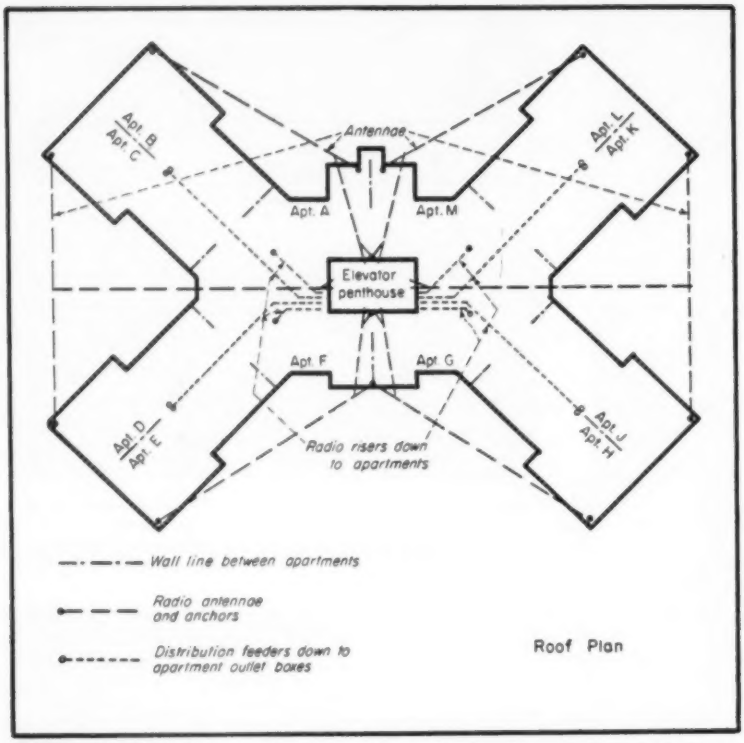
The new main floor ceiling is divided into five bays to match the existing ceiling under the balcony. Acoustic tile is used throughout. Lighting in each bay is provided by a fluorescent ceiling cove and a large rectangular, surface-mounted fluorescent fixture. Each center fixture (Columbia) is 12 feet long, 3 feet wide; extends about five inches below the ceiling; has 12 six-foot, warm white fluorescent lamps enclosed in Holophane low-brightness lens panels. Its 800-pound weight is supported by bolts anchored between the Q-floor cells. After two weeks operation, lobby lighting intensities approached 100 footcandles of glare-free illumination compared to approximately 10 footcandles before. Behind the teller cages (under the former balcony) lighting intensity was increased by doubling the number of fluorescent fixtures to blend with the new lobby system.

Second floor lighting above the new ceiling (accounting department) consists of two continuous rows of 3-lamp, 8-foot (Columbia) fluorescent fixtures rod-suspended from the cross beams of the original lobby skylight. Each row contains eight fixtures. A single continuous row of similar fixtures are surface mounted on the existing ceiling of the balcony area on each side of the skylight.

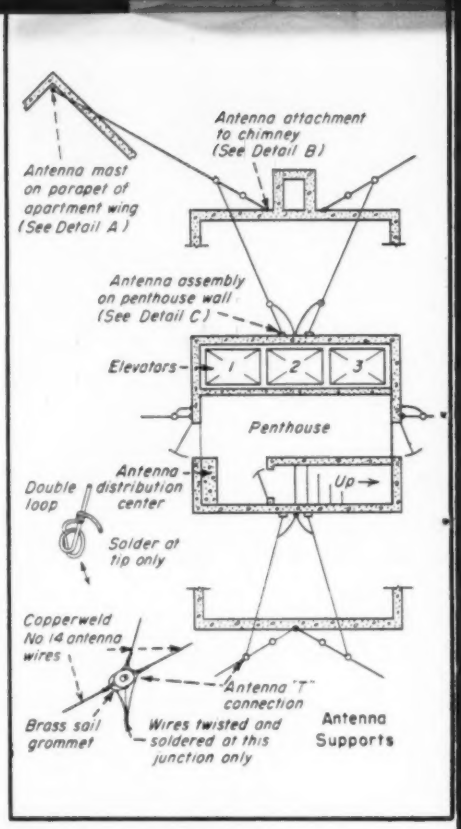
The original lobby lighting was controlled from a panel on the second floor (then mezzanine). This old-style panel was replaced with a modern 40-circuit, circuit-breaker unit to control the new lighting and additional circuits for accounting and business machines. Raceways from this location carry circuits to a header and the Q-floor cells which are used as branch circuit raceways.

Bank officials wanted to control the new lobby lighting from a single location on the main floor. To solve this problem, Wasatch engineers used a low-voltage relay control system to provide a single dial-control.

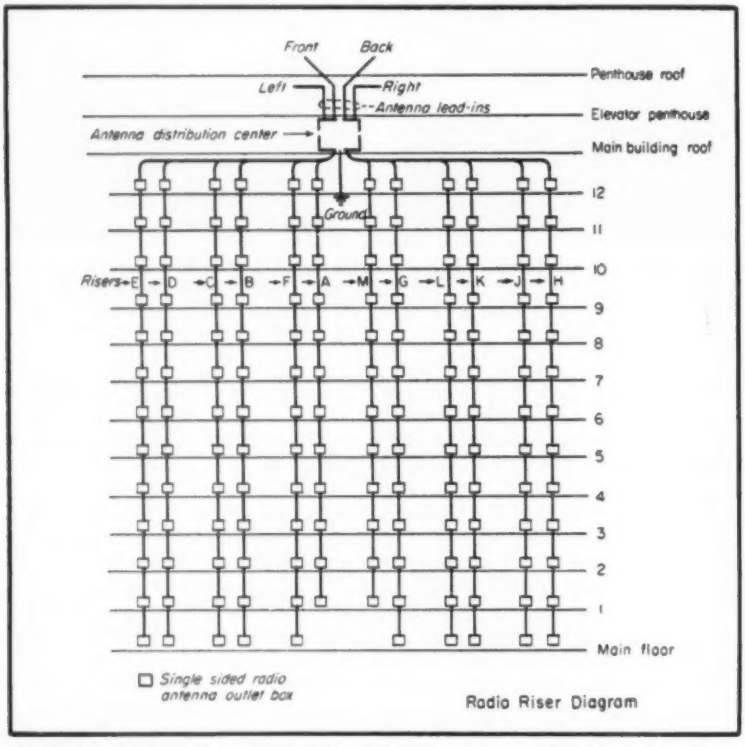
During banking hours both coves and center fixtures are used. After hours, the center units can be turned off and just the coves used in the lobby area, if desired.



RADIO ANTENNAS are mounted on the roofs of each apartment unit, their lead-ins terminating in a penthouse-based distribution center. Coaxial feeders fan outwards from this center, then drop vertically to lower floors.



ANTENNAS ARE ANCHORED to masts on parapet walls, to plates bolted to coping sills or to chimney brackets.



COAXIAL FEEDERS in separate rigid conduit risers serve either 12 or 13 single-sided outlet boxes each. Distribution center equipment is permanently grounded to the cold water system of the building via a bare conductor carried in a separate conduit line.

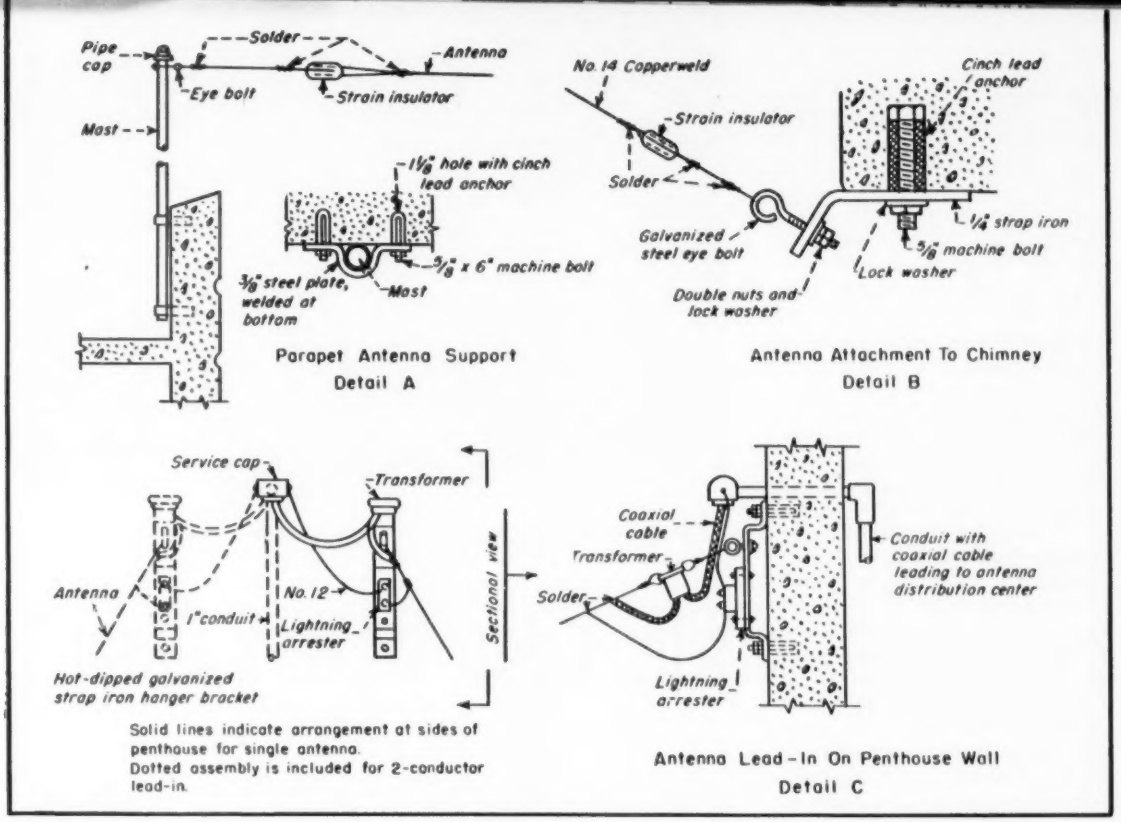
TESTED

By
Hugh P. Scott

RESIDENTS of San Francisco's ultra-modern Parkmerced "tower apartments" (EC&M, Dec. 1952) have optimum-quality TV and radio reception *guaranteed* to them. This is a sizable commitment by the owner-operators, since apartments in the eleven 13-floor tower units number 1700.

Yet the guarantee is not without insurance, for master antennas serving the buildings were designed and *installed* with attention directed to every detail from aerial anchors to outlet multicouplers.

As indicated by accompanying sketches, each tower unit now has six roof-mounted radio antennas; each antenna serving two tiers of either 12 or 13 apartment outlet boxes. Each antenna is equipped with a separate



MASTS AND BRACKETS are secured by machine bolts, lock washers, double nuts and lead cinch anchors. Antennas are grounded through lightning arresters to service caps and the internal conduit system. Coaxial taps are run from antennas through transformers to distribution centers.

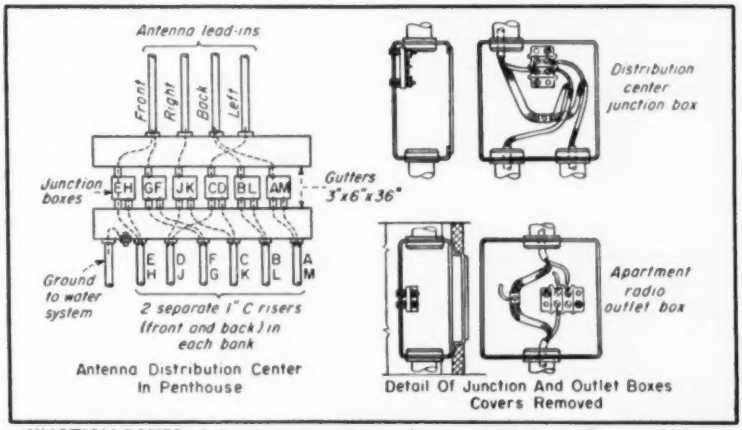
TECHNIQUES FOR INSTALLING A MASTER ANTENNA SYSTEM

Top-flight TV and radio reception can be *guaranteed* to apartment dwellers through the installation of approved equipment anchors, positive grounding, bonded cable connections, coaxial feeders, signal-boosting transformers and outlet multicouplers.

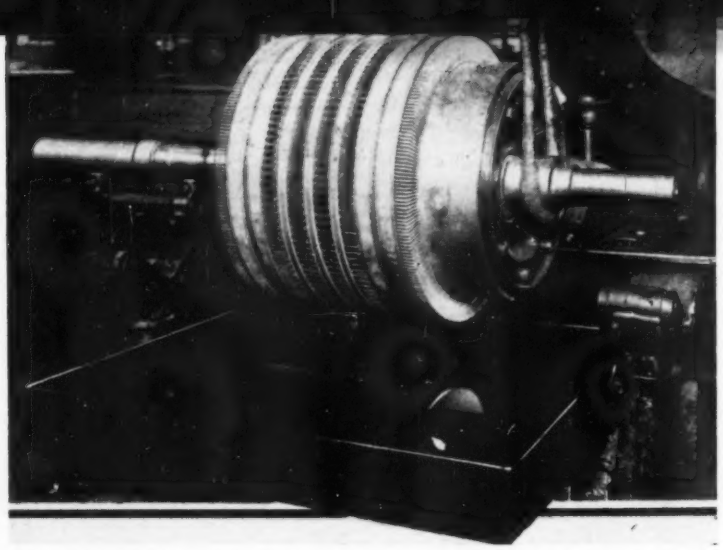
transformer for boosting input level of signals, a lightning arrester and coaxial lead-in to a central penthouse-based distribution center. TV antennas will be installed at a later date.

Antennas are Number 14 Copperweld aerial wire, fitted at each end with strain insulators and anchor cables looped through galvanized-steel eye bolts. Cable ends are uniformly secured by twisting the ends back along their own lengths, then soldering the connections to promote electrical as well as mechanical bond. Connections between antennas and their respective lead-in cables are made by double-looping the various aerial sections around brass sail grommets, then twisting and soldering the free wire tips together.

(*Continued on page 227*)



JUNCTION BOXES of distribution centers and radio outlet boxes serving individual apartments contain Jones 141 series terminal strips to facilitate coaxial connections. Shielding braid of the conductors is split away, soldered, punched and grounded in every box.



LARGE ARMATURE wound and ready to be dipped into insulating varnish.

Why Keep Motors Clean?

How clean is clean? What does cleanliness mean in the case of electric motors? The subject is one of top importance in industrial maintenance. The author covers the range of dirt and contaminants encountered in various industrial surroundings and their effect on motor performance and life.

By F. C. Brown
Lynn Motor Engineering
General Electric Company

THE electric motor has become one of our most versatile and dependable servants. In our homes the electric motor warms us in winter, cools us in summer, preserves our food, cleans our house, washes and dries our clothes, mixes our food, sews our clothes and does many special jobs. These motors require so little attention that they either run automatically or will function at the flip of a switch and little thought is given—or is required—to their care and cleanliness.

Industry has many thousands of applications for electric motors. These motors run in all sorts of conditions—from the spotless laboratory to the dirty coal mine, and industry (like the home owner) has learned to expect great dependability and long life from its tireless servants. However, a great many motors run in less desirable conditions than found in the home, and to have them operate at maximum efficiency it is necessary to take reasonable care of them. Care in addition to proper application, means principally keeping motors clean and free from contaminants.

Enclosures

The nature of air-borned contaminants dictates to a large degree the type of motor enclosure which should be used. For adverse atmospheric conditions where harmful dusts, gases, or liquids are present, the use of totally enclosed motors is recommended. Since open motors require more care in cleaning than totally enclosed units, it is proper that we confine our discussion to the means of best servicing this particular classification of motors.

The effort expended in cleaning motors periodically pays real dividends in dollars and cents saved. A motor covered with dirt or dirt accumulation in the ventilating passages, restricts the normal dissipation of heat. Under such a condition, the motor may very likely overheat, shortening the life of the insulation, ultimately cause insulation failures and result in maintenance expense which need not have occurred if the motor had been kept clean. In addition, a clean motor means a more efficient motor, for then it can deliver its rated output with a minimum loss—more horsepower per dollar of power cost. Operating expense can be cut down by preventing motor failures, for this not only saves on maintenance, but also minimizes losses on production shut downs.

It is well to bear in mind that dirt accumulation not only may result in motor over-heating (and consequent shorter life) but dirt and contaminants may actually attack the insulation and ultimately result in breakdowns. In addition, it may cause excessive wear on commutators and brushes, affect commutation and shorten the life of bearings. In brief, dirt is one thing that electric motors can well do without if the maximum of service and dependability and the minimum of maintenance are to be realized.

Contaminants

Let us look at the nature of dirt and contaminants and their effect on electric motors.

Contaminants may be divided into six classes:

1. Dust and dirt such as suspended airborne soil, organic matter, silica, clay and metallic particles.
2. Carbonaceous particles from smoke, soot and brush wear.
3. Hydrocarbons such as fuel, lubricants and solvents.
4. Salt and moisture such as in sea air, salt spray and salt water immersion.
5. Acids and alkalies.
6. Hazardous gases and dusts (these require special explosion-proof or dust explosion-proof motor enclosures.)

Contaminants may be present singly or occur in a wide range of composition and character, and may be deposited in an infinite variety of ways. For instance, we would assume that practically the only contaminant on board ship would be sea water. Actual tests prove that dirt scraped from various parts of a ship contained lint, clay, carbonaceous particles, salt, silica and hydrocarbons. These contaminants are mostly airborne and as such can easily be deposited on or in electric motors.

The protective treatment given motor windings generally consists of several dips in varnish which (among

other things) forms a tough and durable coating highly resistant to moisture and oil. As an illustration of the effectiveness of varnish treatment on coils, a dc motor was recovered from the ill fated submarine "Squalus" which had been under sea-water for several weeks. The motor was thoroughly dried out, baked and placed on test. The motor developed its full rated output with no signs of damage of deterioration of the insulation. Of course, the motor was practically brand new and the insulation with its varnish coating had no breaks or cracks in it to allow sea water to work its destructive way.

If the insulation is so good on motors, why are we so concerned about keeping them clean? Frankly, it is due to the fact that the insulation does not stay the same as when it left the factory. Over a long period of time, the insulation deteriorates due to oxidation and dehydration processes. Varnishes lose their resiliency and tend to crack under oxidation. The cellulose materials used in insulation become dry and brittle from dehydration and shrinkage takes place.

Heat

Heat accelerates these changes and in combination with vibration tends to produce cracks and breaks in the insulation. As soon as this occurs, the danger signal is up, for any conducting material deposited on the windings may thus cause a short circuit or ground, and the motor must be repaired before it can operate. The mere fact that a motor may run for years covered with dirt is no guarantee that it will continue running without trouble. The potential source of danger should be removed and the motor kept clean.

The exposure to liquid contaminants (e.g. water or oil) can be particularly harmful. Dried out insulation tends to absorb such liquids thus lowering electrical resistance and dielectric strength. In addition, liquid contaminants will hold and spread solid contaminants (such as carbon dust) thus forming an easy patch for current to flow in the presence of a voltage differential.

A particularly tricky type of contaminant (e.g. salt) is one which, when dry, is not harmful, but when exposed to humidity or moisture becomes a potential hazard in its ability to conduct current. The insidious behavior of such a material may allow motors to pass a high-potential test and subsequently cause failure during a less severe test or in service. Also, the presence of ionizable materials near a damaged spot in insulation tremendously increases the hazard of a breakdown. As insulation ages and the protective varnish deteriorates, these materials become a more active hazard to insulation.

Mechanical Parts

In addition to the detrimental effects of contaminants on insulation, they can raise havoc with commutators, brushes and bearings. Abrasive dust will cause rapid wear of commutators and brushes; chemical fumes will attack the surface film on commutators, upset commutation and cause threading; and grease or oil on commutators will result in poor brush operation and selective commutation as the oil film will introduce a high resistance path in the brush circuit and cause some brushes to take more than their share of the current. (In this latter condition, one of the most common causes for getting oil or grease on commutators is over-lubrication of the bearings. Extreme care should be taken to lubricate bearings only when needed and then only in the proper amounts. On ordinary applications like machine tools, pumps, conveyors, etc., there are many ball bearing motors that can run from 3 to 5 years without regreasing.) Dirt of any kind should be prevented from entering bearings, for the presence of dirt can damage shaft surfaces, bearings and lubricant, and materially shorten the life of the bearings.

Motors should be cleaned periodically and the frequency of the cleaning process depends upon the application and operating conditions. Motors in vacuum cleaners are seldom if ever serviced, oil burner motors may be checked once a year, whereas motors in some applications (such as carding rooms in textile mills) should be cleaned every week or two. No definite rule can be established for cleaning schedules but generally speaking motors should be cleaned before dirt accumulates to the extent that operation of the motors would be affected.

Special Conditions

Some applications which require definite cleaning schedules are the following:

Textile—Motors operating in an area where there is considerable fuzz or lint in the air would be cleaned very frequently as the lint can easily plug air passages, accumulate on fan blades, foul up rotors and sometimes even work its way into bearings. Not all applications in the textile industry, not all types of motors require a cleaning schedule, but wherever there is a tendency for dirt to collect on motors a definite check should be made periodically.

Woodworking—The problem here lies in the sawdust. Motors should be properly protected and in addition should be kept free from any accumulation. Clean sawdust is not in itself harmful to insulation, but it will prevent proper heat dissipation if allowed to build up on the motor frames. Overheating many result with consequent damage to the insulation and shortening of the motor life. In addition, sawdust will absorb moisture and in this condition is definitely harmful if in contact with insulation.

Machine Shop—This is one of the more popular applications and requires all types and kinds of motors. The waste products of machining (metal dust and chips) in combination with cutting compounds and oils make a potent combination for causing all sorts of trouble for motors. Many machine tools use built-in motors and offer adequate protection for them, but those motors which are exposed should be checked frequently and cleaned if necessary. Most machine tools now use enclosed motors as fine iron dust not only is destructive to insulation but plugs air gap of open motors.

Engine Room—Oil fumes are prevalent in engine rooms (particularly on shipboard installations) and these fumes have a tendency to deposit on motor winding a sticky film which holds any foreign matter that comes in contact with it. DC motors are very common for ship service, and as the brushes wear on the commutator, the carbon dust may spread through the machine. The normal circulation through the motors will carry this carbon dust away, but if the motors are covered with an oil film the dust will stick to it and form a good path to ground.

Cement Mills—A considerable quantity of abrasive dust may be present in these installations. The motors should be adequately protected so that none of the dust comes in contact with wearing surfaces. In addition, the dust should be prevented from accumulating on motors due to its blanketing effect and thus causing them to overheat.

Chemical Plants and Paper Mills—Here, sulfur fumes, chlorine fumes, and caustics, are ever ready to attack vulnerable parts of motors. Any exposed metal surfaces will be affected and special precautions should be taken to see that they are properly protected

and cleaned when necessary. *Commutators and brush riggings on dc motors should be checked often.* In addition to fumes, motor failure may occur because of actual chemical contamination. In one magnesium plant installation, a motor was discovered to have grounded field coils. Under micro-chemical analysis, the contaminants were found to be magnesium chloride and other hydroscopic (moisture absorbing) salts. These materials did not injure the varnish film, but formed a conducting path through cracks in the film and around the leads into the coil. In addition, magnesium chloride will decompose cotton insulation.

Laundries and Dairies—Considerable steam and moisture abound in these installations. Long exposure to moisture will eventually deteriorate insulation and if other contaminants are present, will considerably shorten the life of the insulation and the motor. Motors should be checked often, especially if they have been in service a long time to make sure there is no contaminant accumulation and that the insulation shows no sign of failing. Dairy applications require daily cleaning for sanitary reasons. Therefore, these motors are subjected to severe moisture conditions and may require more frequent checking.

These are but a few of the many special uses for standard open motors. Of course the use of totally enclosed motors and motors specifically designed for a particular application will eliminate most of these maintenance problems. But no matter what the application is, bear in mind that clean motors run longer and give less trouble.

Insulation Check

One of the good indications of the condition of a motor is to check its insulation. This can be done in several ways, but the most common is to take the insulation resistance in megohms (million ohms) between a winding and ground. This should be done periodically (at least once a year) and comparison with previous reading will indicate any deterioration. Readings should be taken under the same conditions and, if possible, with the motor at its normal working temperature.

One method of obtaining insulation resistance is by use of a megohmmeter. This is a self-contained measuring instrument which gives a direct reading of insulation resistance. Complete instructions are furnished with the instrument, but it reads the insulation resistance in megohms when the leads are connected across the resistance to be measured and its handle is spun by hand.

Another way of checking insulation resistance is by the voltmeter method on a dc line. A 500-volt instrument is used, or one having a resistance of about 100 ohms per volt. The motor should have all of its leads disconnected from the line. Check the line voltage which will be "E" in the following formula. Then connect the ungrounded dc line through the above voltmeter to a motor lead and the other dc line through a 10-ampere fuse to the motor frame. Meter reading is "E_1" in the formula, "r" is the meter resistance and "R" the insulation resistance in megohms:

$$R = r \times \frac{(E - E_1)}{E_1}$$

Example:

$$R = 50000 \times \frac{230 - 50}{50} = 0.18 \text{ megohm}$$

AIEE Standards have established the following "Normal Insulation Resistance Value":

$$\text{Megohms} = \frac{\text{Rated Voltage Machine}}{\frac{\text{Rating in KVA} + 1000}{100}}$$

Approximate values are as follows:

220 volt motor—0.2 megohm
440 volt motor—0.4 megohm
550 volt motor—0.5 megohm

An indication of insulation condition can be obtained by the corona starting test. Corona is the luminous discharge due to the ionization of the air and occurs when the potential gradient in air exceeds a certain critical value so as to produce ions. An ac voltage is gradually applied to the winding under test and the corona starting voltage is determined by use of the resonant circuit method and indicated on an oscilloscope. If the insulation has deteriorated, the corona starting voltage will be much less than that for good insulation. This method requires special equipment which is not readily available and therefore is not in general use. However, it does present a fairly accurate means of checking insulation and has the added advantage of being non-destructive.

Dielectric Test

Test for dielectric strength (high potential test) may be taken on motors which have been in service for some time, but reasonable care should be used in applying the test. Dielectric strength of an insulating material is the maximum potential gradient that the material can withstand without rupture. The high potential test on new integral horsepower motors is generally taken in accordance with AIEE Standards which specify that the dielectric strength of motor insulation should be tested by the continuous application for one minute of an alternating voltage whose effective value is 1000 volts plus twice the rated voltage of the circuits to which the machine is to be connected. Motors in service should not be tested with the maximum high potential voltage as specified by A.I.E.E. for new motors. When such a test is taken the value of the test voltage is 75% or below that used on a new motor, depending upon the condition and the quality of the motor insulation. This test can be destructive for if the insulation is weakened the application of the test voltage may break through the insulation and the motor must be repaired before it can be used. The test is valuable however, in determining the location of short circuits or grounds in the motor and may actually indicate weak spots in the insulation which eventually would cause the motor to fail.

Cleaning

Cleaning motors is a relatively simple operation. The outside surfaces may be cleaned by brushing or wiping using a heavy brush or wooden scraper, being careful to prevent any dirt from falling into the motors or plugging ventilating passages. Light, dry, comparatively harmless dusts can be blown off from outside or inside surfaces by the use of low pressure, dry air. Any contaminating dust such as grit, iron dust, carbon and copper dusts should be removed by suction. If compressed air is used, these dusts may be blown into more vulnerable parts of the motors, ultimately resulting in an insulation breakdown. As a precaution, hose tips for either suction or pressure cleaning should not be of metal.

Dirty surfaces, which resist treatment by the foregoing methods, may be cleaned by the old-fashioned remedy of soap and water. It is necessary, of course, to see that all insulating and conducting surfaces are thoroughly dry before the apparatus is used. Detergents are liable to leave a film after their use, which may be detrimental to the insulation so a rinsing in clean water is advocated.

Grease, oil, or sticky dirt can be removed by the conservative use of a suitable solvent. Do not soak insulated parts as excessive solvent may work its way into inaccessible places, where it may soften and harm the insulation. Use just enough solvent to loosen the dirt so that it can be wiped off. If dirt is excessive, it may be necessary to repeat this process several times. A small paint brush dipped into the cleaning solution, may be used for getting

into corners and crevices. Solvents should not be used near an open flame, and it is highly desirable to apply them in a well ventilated area.

A good varnish treatment will do three things:

1—Penetrate the coils and thoroughly fill all air spaces thus allowing better heat conduction to the surface.

2—Effectively bond wires together and prevent movement.

3—Provide a hard, tough coat which resists oil and moisture.

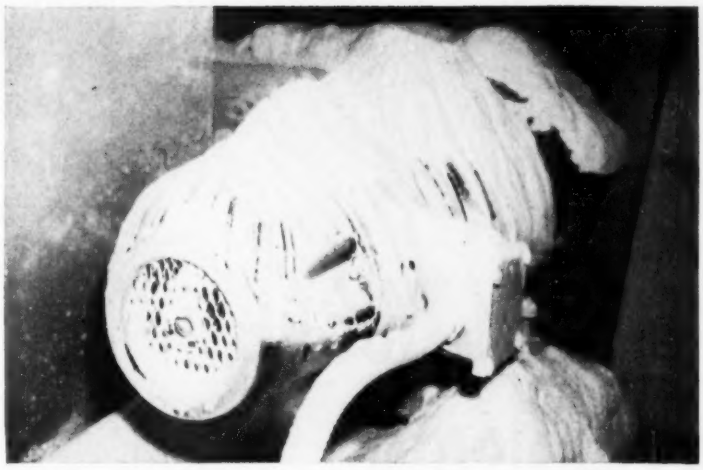
The varnish treatment normally used is to dip the windings two or more times, each dip followed by oven baking at a recommended temperature and time. The dipping may be accomplished with or without a prebake. Prebaking is advantageous as it will tend to drive out moisture, and dipping hot coils facilitates varnish penetration. Use only those varnishes which are recommended by the motor manufacturer, as some varnishes contain solvents which are detrimental to insulation. Also, follow manufacturer's instructions on proper methods of varnish treating and baking.

Before applying any varnish treatment care should be taken to have the windings thoroughly clean and free from dust and dirt. While applying varnish, do not block off ventilating ducts, and clean off all varnish that gets in between connections or on commutating surfaces.

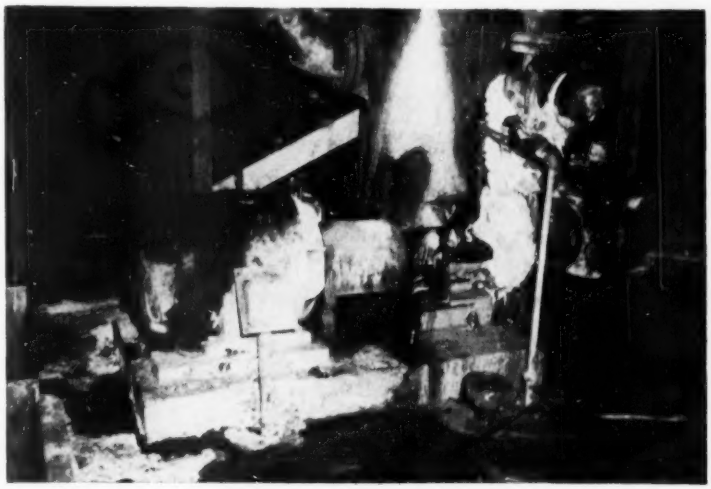
If it is impossible to apply a thorough varnish and baking treatment, the weak or damaged spots in the insulation can be varnished with an aid-drying material. This varnish should have good properties of toughness, adhesion, oil, and moisture resistance, good dielectric strength, and long life under heat.

Summary

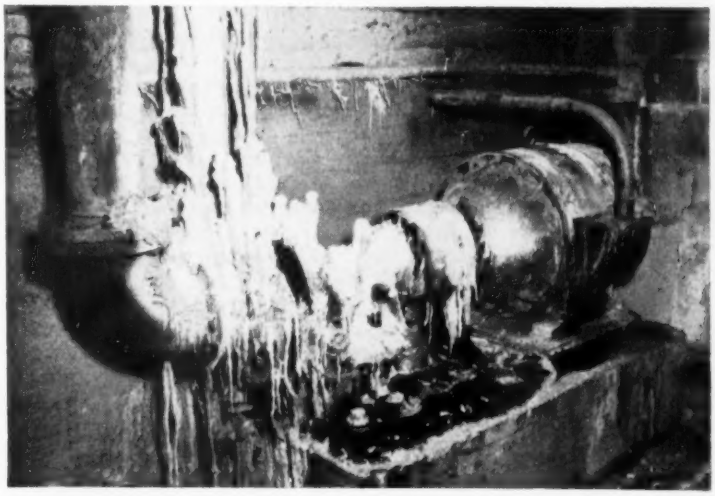
Clean electric motors in any installation have definite advantages. Keeping equipment free from dirt is a source of pride for it is excellent evidence of good housekeeping. Clean motors appeal to the pocketbook for they reduce maintenance and operating expenses, as well as lasting longer and giving less trouble thus contributing greatly to owner's satisfaction. The time and effort expended in cleaning is relatively small if definite schedules are established, for it is much easier to keep a clean motor in that condition than it is to dig off the accumulated contaminants on a dirty motor. Industry has many millions of dollars expended in electric motors. Protect that investment by keeping motors clean.



TOTALLY ENCLOSED, fan cooled, squirrel cage induction motor driving potash belt conveyor.



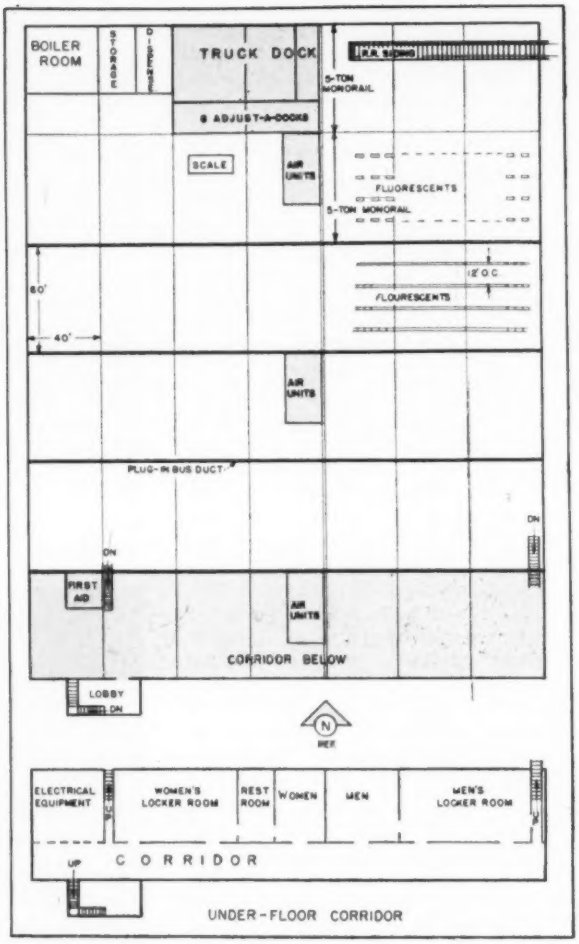
TEFC MOTOR on a tower pump handling a salt solution used in making soda ash an example of severe operating conditions.



MOTOR DRIVING a flash cooler pump. The liquor is pumped to a cooler where some steam is flashed off.

A Plan for ELECTRICAL EXPANSION

Flexible busduct distribution, a 265-volt lighting system with circuit contactors remotely controlled, electro-pneumatic regulation of heating equipment and provisions for primary feeder selection are features of Black & Decker's new plant designed by The Austin Company and wired by electrical contractors Blumenthal-Khan.



PLUG-IN BUSDUCT on 60-foot centers provides 480/277-volt power for all areas of Black & Deckers new production plant. Fluorescent lighting in continuous rows delivers 50-footcandles to working areas. Light level is 30-fc in areas where lamp spacings are staggered.

THE initial section of what ultimately will be a plant containing a million sq. ft. of floor area has recently been erected at Hampstead, Maryland, for Black & Decker—the world's largest manufacturer of portable tools. Designed and built by The Austin Company and electrically wired and equipped by contractors Blumenthal-Khan of Baltimore, the building incorporates progressive features in both the electrical and structural fields.

As subsequent sections are added, a selective primary distribution system will be developed so that dual-feeder protection will be available to insure power continuity. Multiple substations will duplicate the 750/1000-kva 13.2-kv/480-277-volt air-cooled indoor unit that serves the presently-existing load, and plant distribution will expand the 400-amp 3-phase 4-wire plug-in busduct system which now spans the plant.

This distribution system provides 460-volt power for motor operation, and 265-volts between phase and neutral for lighting in all general factory areas. With the neutral grounded, the system provides for immediate isolation of any possible ground faults before they develop into double line to ground faults and trip out a considerable portion of the load.

Lighting panelboards in the main factory areas are equipped with contactors which may be controlled remotely from a central pushbutton station.

Illumination in these manufacturing sections is provided by 2-lamp 100-watt fluorescent fixtures mounted end-to-end on continuous troughs secured to the underside of roof trusses. With troughs on 12-foot centers at a height of 15 feet, intensities of 50 footcandles are provided for working surfaces.

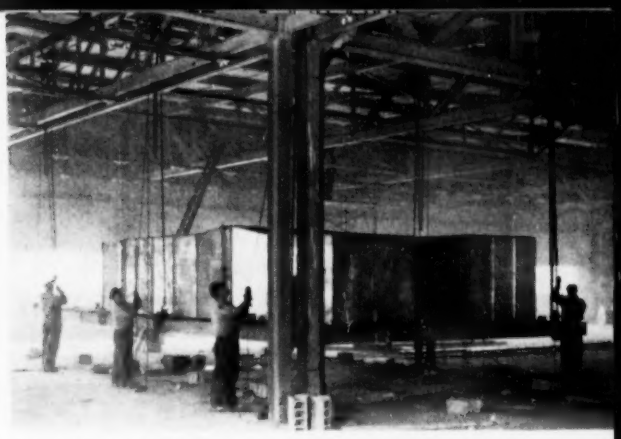
Storage and service areas are lighted at present to a level of only 30-fc, using the same fixtures as those selected for manufacturing sections but having staggered spacings along the continuous troughs. If it becomes desirable to raise intensities at a later date, it can be accomplished merely by installing additional lighting components in the now-vacant standard-length gaps.

At intermediate points, these continuous troughs are supported by messenger cables that extend between trusses and are anchored to upper flanges of beams forming the lower truss chords.

Truck docks and boiler room spaces are provided with 20-fc from incandescent RLM dome fixtures. The basement corridor is similarly lighted, but luminaires are mounted close to the ceiling between deep beams, thereby obtaining shielding against glare in



PRODUCTION MACHINES may be readily shifted and reconnected to busduct network in accordance with future changes or expansion of various working areas. Power is distributed overhead throughout the plant, leaving the wood-block floor unobstructed.



UTILITY PLATFORMS, with pre-assembled air-handling units, electric fans, filters and associated equipment installed at floor level, were raised as packaged units to roof-truss level where they were secured above lighting fixtures and busducts.



MESSENGER CABLE, secured to upper flanges of lower truss beams, supports continuous lighting troughs at intermediate points. Trolley-duct branch lines, connected through 480/120-volt dry-type transformers to busduct feeders, provide power for portable tools.



FIELD AND STATOR WINDING department receives component parts and materials in barrels on pallets transported by industrial trucks. Handling of heavy material in warehouse sections adjacent to truck docks and railroad siding is by means of monorail crane.

the direction of travel and vision.

This auxiliary lighting operates at 120-volts, provided through small step-down dry-type transformers connected via breaker units to the 400-amp 480/277-volt plug-in bus-ducts. Portable tools are powered from these same dry-type units.

The already-completed section of the plant measures 280- by 360-feet, has a wide column spacing of 40- by 60-feet, has a vertical clearance of 15 feet to the under side of roof trusses and incorporates Austin's "unit area system" for the installation of power distribution, ventilation and heating equipment. These equipments were installed on platforms which were raised into position between trusses as "packaged utility units".

In the present building there are three such platforms, each supporting two air handling units to provide primary heating and ventilation for the plant. Platforms also support associated electric fans, filters, mixing chambers, duct outlets and heating coils. Space for the later addition of cooling coils is likewise provided.

Supplementary heat for the main floor is provided by electric propeller-type unit heaters, while normal ventilation and spot exhaust is handled through nine motorized ventilators.

All employee service facilities are located below the main floor, adjacent to a 40-foot wide corridor that extends along the front of the present structure. When the ultimate building is completed, this corridor will be located beneath the center of the structure and will be extended in both directions to form a tunnel some 1200 feet in length. It will accommodate vehicles used for service and supply, will result in keeping the production level free of obstructions, and will preclude the necessity for multi-level operations with related complications in area utilization.

Power is received underground at 13.2-kv, is transformed to 480/277-volts at the basement substation, then is carried upward to the truss level where it is distributed overhead along each column line via plug-in bus. The flexibility of this distribution system permits wide latitude in functionally laying out flow-of-material lines, receiving and shipping facilities, and production equipment for such operations as heavy casting, heavy tool assembly or spray painting. With wide column spacing and ample power sources throughout the plant, unit areas may be expanded and manufacturing equipment shifted in accordance with any change in production schedule.

PROGRAM

Sunday – May 24th

Registration – 9:30 A.M.-10:00 P.M.
Evening – President's Reception.

Monday – May 25th

Registration.
Morning – Business & Management Topics with question and answer periods after each subject.
Afternoon – Boat trip around Manhattan.

Tuesday – May 26th

Morning – Motor & Transformer Shop subjects with forum type questions after each subject.
Noon – Chapter Officers' lunch.
Afternoon – Shop or sightseeing tours.
Evening – Theater.

Wednesday – May 27th

Morning – Management & Sales Subjects.
Noon – Annual lunch followed by annual business meeting.

Thursday – May 28th

Morning – Shop & Technical Subjects Forum.
Afternoon – Shop or sightseeing tours.
Evening – Annual banquet.

NISA *20th Convention New York Bound*

Annual convention of National Industrial Service Association scheduled for Hotel Statler, New York, May 24-28

MORE than 1,100 persons are expected to attend the 20th Anniversary Convention of the National Industrial Service Association, the national trade association of electric motor repair and rewinding shops, at the Hotel Statler, New York, May 24-28.

The convention program includes four morning sessions, Monday, May 25 through Thursday, May 28, on technical and business subjects. Speakers include Paul Richards, service manager, Electro Dynamic, Bayonne, N. J., who will talk on "Reduction of Noise and Vibration in Electric Motors:" D. H. Lory, assistant to the general manager, Allis-Chalmers Manufacturing Co., Norwood, Ohio, whose subject is "Is Electrical Equipment Part of Your Life?;" Albert Clot, president, Peninsular Armature Works, Miami, Fla., who will speak and conduct a demonstration on "Dynamic Balancing;" and R. E. Ward Sr., president, Electric Motor & Repair Co., Raleigh, N. C., who will deliver a paper on "Making Small Transformer Winding Profitable."

Business subjects include "Insurance for the Motor Repair Shop" by Robert J. Ford, general manager, John T. Ostheimer Agency, New York; and "The Past History of NISA and Its Promise for the Future" by William J. Wheeler, president, The Maintenance Co., New York, and a past-president of NISA.

Afternoons during the convention will be devoted to tours of New York Electric motor repair and rewinding shops and sightseeing tours. A complete ladies' program has been scheduled, including breakfasts, luncheons, fashion shows, sightseeing trips.

The association's annual banquet will be held Thursday evening, May 28, with Clayton Rand, editor, The Dixie Guide, Gulfport, Miss. as the guest speaker.

H. Q. Griffith, general chairman of the convention which is sponsored by NISA's New York Metropolitan Chapter, has announced that all NISA members are being sent announcements of the meeting and forms for advance registration and for hotel reservations.

NISA's membership has been growing steadily since the founding of the Association in 1933. As of January 1, 1953, it included 1,270 Active members and 62 Associate members—a total of 1,332. (Active members are persons, firms, or corporations engaged in the business of repairing, altering, maintaining or otherwise servicing electrical and mechanical equipment; Associate members are companies not eligible for Active membership, but whose interests are closely allied with Active members.)

NISA shops can be found in every state in the United States as well as in Canada, Cuba, Hawaii, Mexico and Puerto Rico.

A full-time staff, including an executive secretary and staff engineer, is maintained at NISA National Headquarters, 818 Olive St., St. Louis 1, Missouri. In addition, there are 29 NISA chapters (including two in Canada), covering areas ranging from a single city to several states. The governing body of NISA is its Board of Directors, one from each of 15 regions, which meets semi-annually.

In the electric motor repair industry, NISA provides the means for joint action and the facilities for exchange of information. Through its Technical Manual, Rewinding Data Book, the new monthly magazine, NISA News, and special bulletins, NISA is continually striving to help its members raise their business and technical standards. Frequent visits by the executive staff, officers, and directors to chapters and member firms help the Association to promote its objectives.

On the local level, NISA chapters hold regular meetings, invite speakers of national reputation to address their groups and hold forums where technical information can be exchanged.


STARR ELECTRICAL CONTRACTORS
SORRY YOU'RE HAVING TROUBLE, JIM... WHY NOT TAKE MY ADVICE AND
FIND OUT FOR YOURSELF WHAT YOU CAN EXPECT FROM GRAYBAR!
...SOUNDS LIKE A GOOD IDEA!
AMES ELECTRICAL COMPANY
HOWDY, MR. BARNES -- CHARLIE STARR SAID YOU'D SHOW ME AROUND OVER HERE AT GRAYBAR.
BE GLAD TO -- CHARLIE'S ONE OF MY GOOD ACCOUNTS.
GRAYBAR
YOU SEE, GRAYBAR'S KNOW-HOW IN SERVING THE ELECTRICAL INDUSTRY GOES BACK 84 YEARS -- TAKE OUR CATALOG AND QUOTATION SECTION, FOR INSTANCE...
WHEN A JOB BREAKS, WE CAN SUPPLY PRICES AND "SPECS" ON EVERYTHING ELECTRICAL, NOT ONLY FROM OUR OWN COMPREHENSIVE CATALOGS, BUT FROM THOSE OF 200 SUPPLIER-MANUFACTURERS.
HMM... MUST BE A BIG HELP MAKING UP BIDS.
CATALOG and QUOTATION SECTION
GRAYBAR'S A NATION-WIDE OUTFIT WITH OFFICES AND WAREHOUSES IN 109 CITIES. IF AN ITEM HAPPENS TO BE OUT OF STOCK HERE, WE CAN USUALLY GET IT ON SHORT NOTICE FROM A WAREHOUSE NEARBY.
IN EMERGENCIES OR FOR PICK-UP ORDERS, USE THIS HANDY COUNTER SERVICE. OUR EXPERIENCED COUNTER SALESMEN WILL GIVE YOU PROMPT ON-THE-SPOT INFORMATION.
NOW... HOW ABOUT A TRIP THROUGH THE WAREHOUSE? YOU'LL SEE MANY OF THE 100,000 DIFFERENT ELECTRICAL ITEMS STOCKED AND DISTRIBUTED BY GRAYBAR.
WAREHOUSE
CALL GRAYBAR FIRST FOR
GRAYBAR
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EVERYTHING ELECTRICAL

SELL THESE APPLETON TIME SAVERS

A More Economical Connector...



PATENT APPLIED FOR

Here is a ½", ¾" or 1" thin-wall connector that costs less, installs faster, provides extra wiring room. Eliminates locknuts. Knurled chamfer bites the rim of the knockout to prevent slippage and provide perfect grounding. *Write for Price Sheet TNI-351.*

A More Efficient Lighting Fixture...



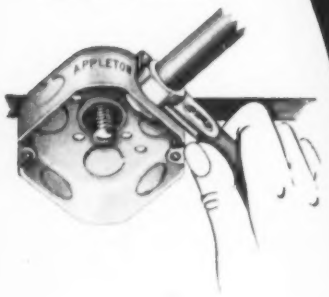
TWIST— IT'S ON!



PATENT APPLIED FOR

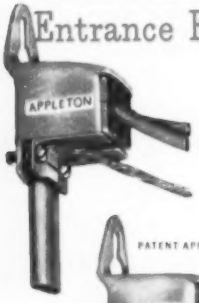
New "V-51" Series. Never before a vaportight lighting fixture so safe, so efficient, so easy to maintain! Exclusive Unit Assembly makes receptacle, globe and guard instantly detachable for re-lamping, *without tools!* Converts for higher or lower wattage lamps just as easily. Reflector has exclusive neoprene rubber ring mount. *Write for Bulletin 5-A.*

TIGHTENS WITH SINGLE WRENCH



APPLETON ENGINEERING, geared to the ever-growing electrical industry, is continually at work to bring you new products - better products - such as the four recent examples shown here...

A Simpler, Stronger Entrance Fitting...

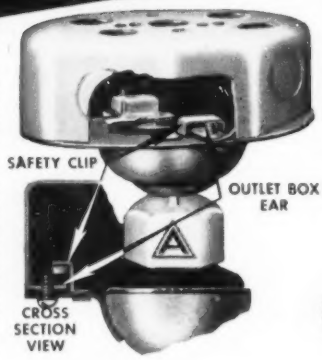




PATENT APPLIED FOR

Appleton OF-1 and OF-2 Service Entrance Fittings combine convenience, economy and greater weather protection. Single-piece bodies eliminate need for separate cover on entrance head. No covers to become lost before installation, loosen or dislodge after job is done. *Write for Price Sheet TNI-451.*

A Much Safer Fixture Hanger Cover...



Positive protection against falling! Safety clips automatically position directly above outlet box ears. Permanently joined to the cover, clips will support weight of fixture even if outlet box screws rust through or vibrate out! An exclusive Appleton safety feature. *Write for Price Sheet TNI-551.*



SWIVELS 30° FROM PLUMB

PATENT APPLIED FOR

Sold Through Electrical Wholesalers

APPLETON ELECTRIC COMPANY

1704 Wellington Avenue • Chicago 13, Illinois

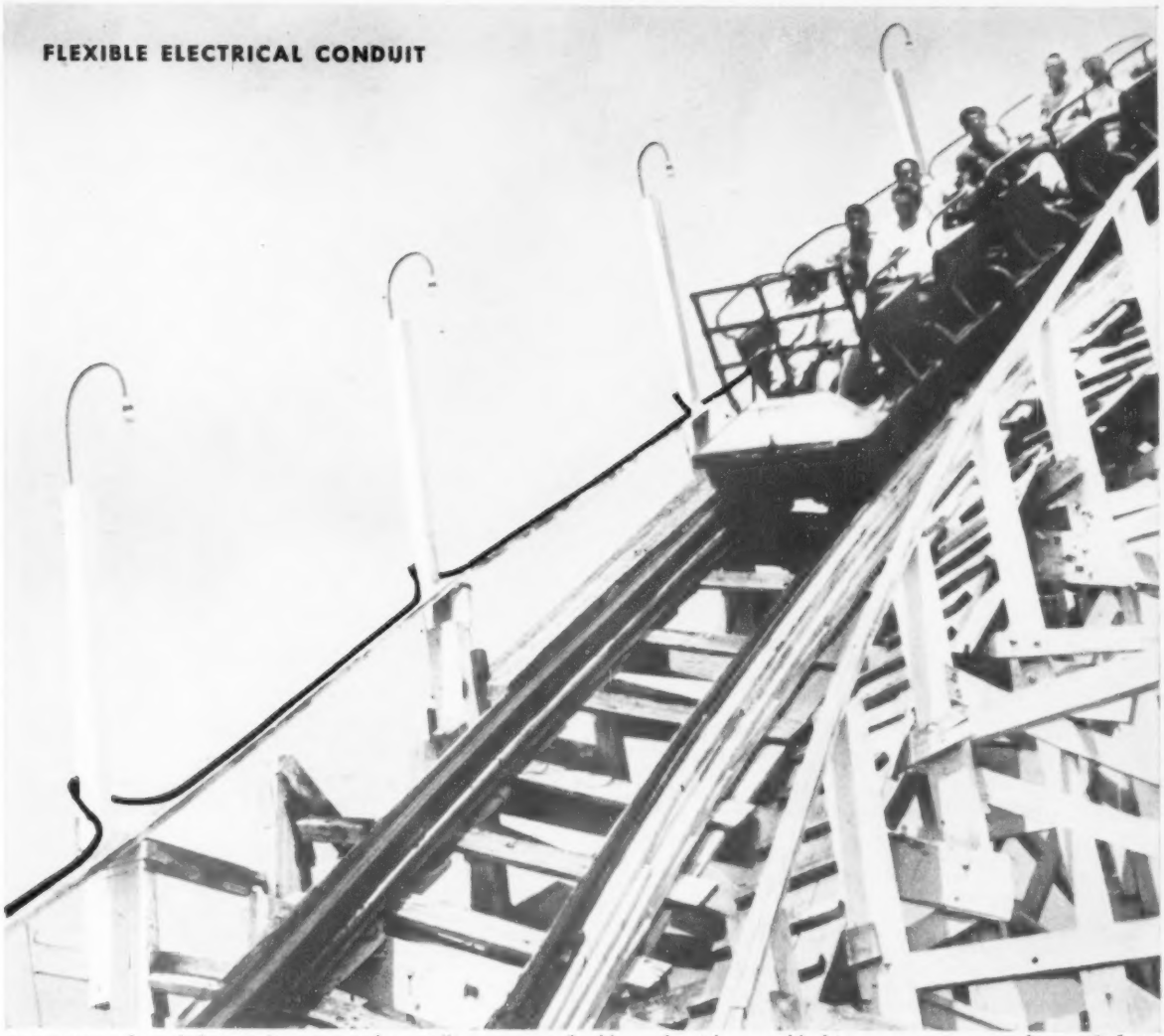
SWITCH BOXES • OUTLET BOXES & COVERS • GROUND FITTINGS
LOCKNUTS & BUSHINGS • COUPLINGS & CONNECTORS (FOR EMT)
REA FITTINGS • SERVICE ENTRANCE FITTINGS & CONNECTORS
BOX CONNECTORS • BAR SETS & HANGERS • OVALTUBE FITTINGS
REELITES—PORTABLE TYPE, CONSTANT DUTY, EXPLOSION-PROOF



HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by GRAYBAR

FLEXIBLE ELECTRICAL CONDUIT



HAIR-RAISER ride made less costly to operate by installing SEALTITE flexible conduit (shown in black) in continuous runs as long as 70 feet.

Salt, shake and bake ——

but SEALTITE stays flexible and liquid-tight

At Santa Cruz, Calif., 100 yards from Monterey Bay, conduit for outdoor wiring meets its toughest test. Flexible SEALTITE* has won hands-down approval from harassed electricians of the Santa Cruz Seaside Company, operators of this roller coaster.

Here the seacoast weather rolls up a formidable combination of corrosive elements. Salt spray. Hot summer days. Winter rains. Night fogs. In nearby offices, paper clips in desk drawers rust within fourteen days. It's that tough.

Add vibration from racing cars that whips wiring and loosens fixtures. Maintaining light bulbs and lead-wire connections is no cinch.

But SEALTITE, first installed here 2 years ago with State approval, looks as good today as then. Its synthetic jacket and strong, steel core are still pliant and unaffected by the elements. Now the Santa Cruz Seaside Company is replacing all outdoor wiring conduit with SEALTITE.

* * *

New SEALTITE Type UA is the first flexible conduit to be approved by *Underwriters' Laboratories, Inc.* It may be used where a flexible connection is desired in wet locations or when exposed to mineral oils (up to 60 C).

Leading electrical supply houses stock SEALTITE and fittings for your convenience. Buy it in easily-handled coils and cut it to length right on the job. *The American Brass Company, American Metal Hose Branch, Waterbury 20, Connecticut. In Canada: The Canadian Fairbanks-Morse Company, Ltd.*

5315G

*Trademark

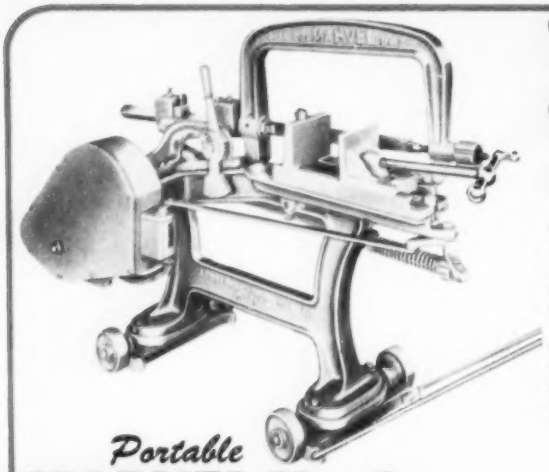
for flexible, liquid-tight electrical conduit — specify SEALTITE an ANACONDA* product



HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by Graybar

The best metal-cutting saw for the shop . . . .
the best to have on the job



The MARVEL No. 1 (capacity 4" x 4") and the MARVEL No. 2 (capacity 8" x 8") Portable Hack Saws are the logical metal-cutting saws for electrical work both in the shop and on the job. They load easily on a truck and go to the point of work on their own wheels. They take the faster-cutting high speed steel blades and permit really effective feed pressures. (You don't have to wait to scratch your way through conduit, pipe, shapes or bars with these general purpose industrial hack saws, they really race through steel.) In their rigid frames, blades can really be pulled taut, and will cut straight and accurately. The No. 2 saw has a quick-action vise that swivels to permit angle cuts up to 45°; and in every way it is—

Portable
MARVEL No. 2
DRAW CUTTING HACK SAW MACHINE

Fast . . . because the simple, rugged construction permits the use of high speed steel blades.

Accurate . . . because the improved Saw Frame with clamping type blade holders holds the blade in perfect alignment and proper tension.

Economical . . . because of its automatic relief on the return stroke, the blade will last and last and last.

Dry Cutting . . . because modern high speed steel blades will operate efficiently at 60 strokes per minute without a coolant.



MARVEL *High-Speed-Steel* Hack Saw Blades and Hole Saws

MARVEL High-Speed-Edge Hack Saw Blades will out-cut all others because they have the finest high speed steel cutting edge. They will out-last other high-speed steel blades because they will not break or shatter—have a tough alloy steel body. By developing this composite construction, MARVEL produces a superior blade that will stand up under any speed, feed and tensioning, indefinitely. And fast, accurate, economical metal-sawing is possible only with high speeds, heavy feeds and a really taut saw blade. All sizes.

MARVEL High-Speed-Edge Hole Saws, because of this same MARVEL composite construction, have sufficient strength for use on drill presses and lathes as well as in portable hand drills. They will saw out holes at low cost in any machineable material (will go through steel plate up to 1⅛" thick) easily and quickly. Until you've used a MARVEL Hole Saw you just can't know hole saw possibilities. Diameters from ⅝" to 4½".

MARVEL Splitting Shears

Economically and accurately cut-off, split and trim flat steel plates and bars.



Model	No. 1	No. 2
Capacity (mild steel)	⅛"	¼"
Length of shear blade	4"	6"
Length of lever	30"	54"

MARVEL Rod Cutters

These simple, hand operated tools easily and instantly cut-off round bars, rods or wire with a single stroke of the lever.



Model	Will cut Round Rods (dia.)	Weight, lbs.
No. 5	⅜, 5/16, ¼, 3/16, ⅛	15
No. 6	⅝, 9/16, ½, 7/16, ¾	45
No. 7	⅞, ¾, ⅝, ½, ⅜	110

MARVEL Drill Press Vises

The sliding jaw is quick action—ratchets and screws tight. For drill presses, milling machines and shapers.



Model	No. 40	No. 41
Capacity	5"	8"
Width of Jaws	5⅛"	7"
Height of Jaws	2½"	4"
Overall length	12½"	17½"
Overall width	5⅝"	7"
Overall height	4¼"	6"

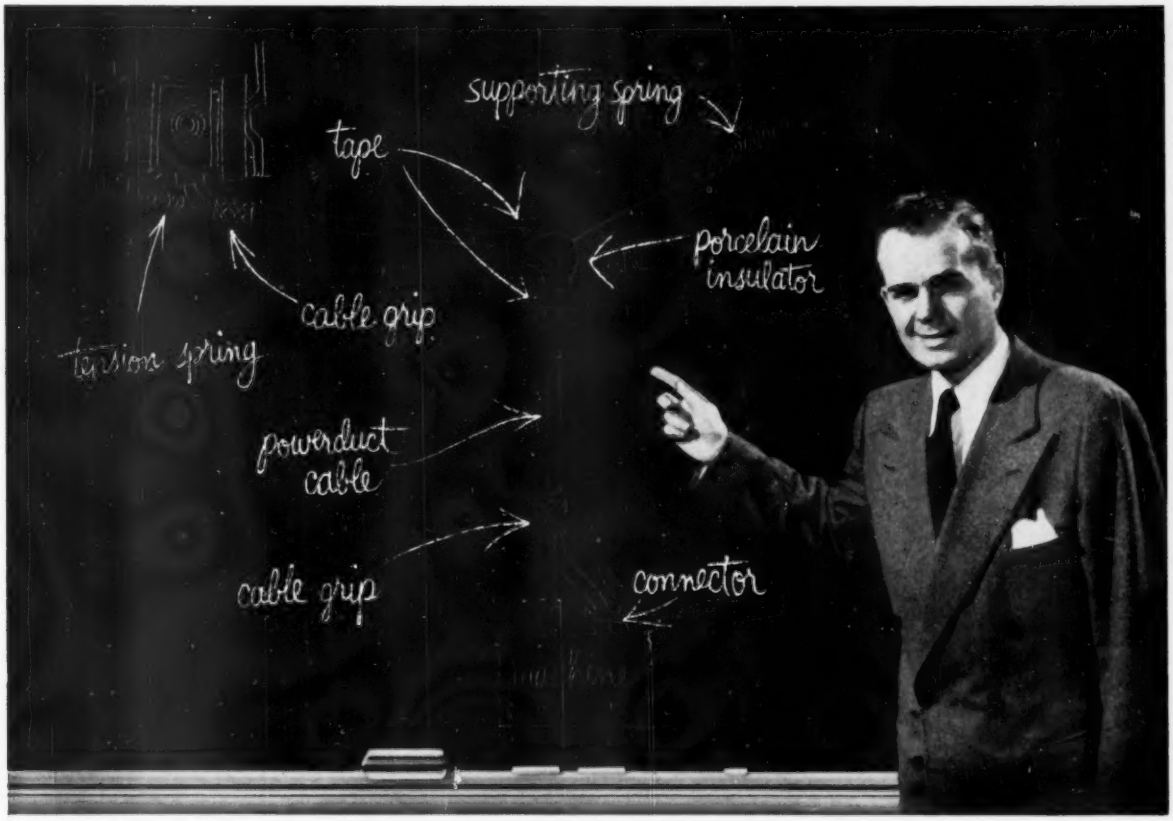
MARVEL *Metal Cutting* **SAWS**
Better Machines—Better Blades

ARMSTRONG-BLUM MFG. CO. · 5700 Bloomingdale Ave. · CHICAGO 39, ILL.



HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA
GRAYBAR

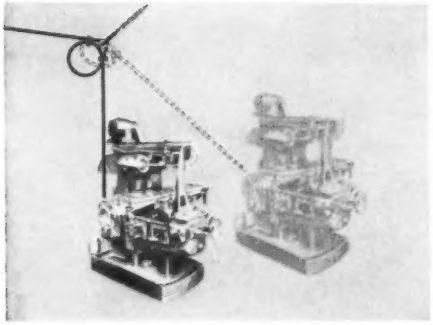
Graybar Distributed by Graybar Electric Company



See how easily flexible Powerduct Cable plugs in. Spring keeps cable taut. For simplicity of installation and relocation, compare this cable with conduit.

No busduct system is truly flexible without this

New Powerduct Cable



Mobility of machinery is increased. Powerduct Cable adds to usefulness of many types of equipment.

the right cable for the job

ANACONDA®

wire and cable

It's the only nonmetallic-armored busdrop cable UL approved for this hard use; cuts cost of relocating machines

Your plant may well suffer from hardening of the power arteries. Here's why. Even if you have a modern busduct system, it may be flexible *only so far as it goes.* You may still have to rip out permanent or semi-permanent wiring every time you rearrange important machines. That's costly.

Here's how to remedy this situation. Match your present busduct system with money-saving ANACONDA Powerduct Cable. It's the only cable of its type approved by Underwriters' Laboratories, Inc. for busway branches under section 3646, 1951 National Electric Code.

You save many ways. Powerduct Cable is much cheaper to install than conduit. It handles easily. Grips prevent cable creep. No time is lost. You get circuit capacity at any point for any load at any time. It's a cinch to relocate. Coil (see illustration) makes local changes easy.

How tough is it? Its flame-retardant jacket, woven like a fire hose, takes heavy mechanical abuse, won't fray. Cold-flow is no problem. Cutting compounds, oil, acid, water, grease won't harm it.

Plan now to add flexible Powerduct Cable to your busduct system. See your regular supplier and insist on the ANACONDA Trademark—your positive proof of UL approval for this use. Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.

HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by GRAYBAR

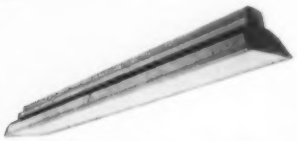


lighting problems SOLVED for every plant location with a specific Benjamin Unit

☑ THIS CHECK CHART OF BENJAMIN LIGHTING UNITS

shows how lighting can be matched to every seeing task in the plant!

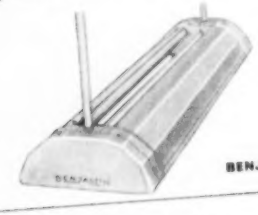
☐ **1.** fluorescent lighting of **GENERAL PLANT AREAS**



Over 300 combinations for matched-to-the-task lighting. Just three channel sizes and four types of reflectors form the backbone of an almost unlimited number of lighting systems for general industrial seeing tasks. Features utilization of high-light-output T12 Slimline lamps and exclusive "Springlox" Lampholders for lower maintenance cost through quicker lamp servicing.

BENJAMIN "Magna-Flo" Systems *described in Manual #1*

☐ **2.** fluorescent lighting to overcome **EXCESSIVE BRIGHTNESS RATIOS**



A new high in seeing comfort for industry! "Task-Master" combines greater upward flow of light with a new high of 35° lamp shielding. Revolutionary new, easier methods of installation and maintenance keep operating and maintenance costs at an all-time low.

BENJAMIN "Task-Master" *described in Manual #2*

☐ **3.** lighting of **HIGH BAYS**



A rugged lighting unit for steel mills, foundries, sheet metal works, and other locations where the lighting units must be guarded against damage from rough handling, flying metal particles, severe mechanical strain or unfavorable atmospheric conditions.

BENJAMIN "Steelite" *described in Manual #3*

☐ **4.** incandescent lighting of **GENERAL PLANT AREAS**



This unit inexpensively matches a variety of general seeing tasks; also for stairways, materials handling areas, etc. Exclusive "Turnlox" detachable reflector cuts time required for cleaning and relamping.

BENJAMIN "Turnlox" Dome Reflector *described in Manual #4*

☐ **5.** lighting for **BINS and SHELVES**



A reflector of unique design, combining uniformity of illumination with careful shielding. Uniformly lights top-to-bottom of shelves, bin tiers in stock rooms, tool cribs and book stacks. Especially adapted for the low mounting heights and narrow aisles of such locations.

BENJAMIN "Stock-Bin-Lite" Reflector *described in Manual #5*

☐ **6.** safe lighting for **HAZARDOUS LOCATIONS**



For locations listed by U.L. as Class 1 Groups C and D. Recommended for areas where explosive atmospheres or inflammable dust is found. Available in a choice of four reflectors and a variety of mountings. Especially constructed to withstand the tremendous pressure of internal lamp explosion.

BENJAMIN "Explosion-Proof" Units *described in Manual #6*

☐ **7.** approved lighting for **HUMID LOCATIONS**



Listed "Vapor-Tight" by U.L. Suitable for use in locations exposed to moisture or non-combustible dust, corrosive fumes, vapors, dust and smoke. Rugged construction, unbroken surface of Porcelain Enamel and heavy-gauge steel assure long life without breakdown or frequent servicing.

BENJAMIN "Vapor-Tight" Units *described in Manual #7*

☐ **8.** proper floodlighting for **OUTDOOR INDUSTRIAL AREAS**



The ideal all-weather unit for industrial recreational areas, ball fields, pools, etc. Highest quality outdoor illumination due to combination of large diffusing Porcelain-Enameled Steel Reflector with inner aluminum reflector.

BENJAMIN "Play Area" Floodlight *described in Manual #8*

R-215

☑ GET THESE FREE LIGHTING MANUALS!

BENJAMIN ELECTRIC MFG. CO., Dept. H, DES PLAINES, ILLINOIS

Without cost or obligation, please send me the Benjamin Manuals on the following subjects, listed in the Check Chart above:

1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐ 8☐

NAME AND TITLE_____

COMPANY_____

ADDRESS_____

CITY_____ STATE_____

BENJAMIN
Lighting Equipment
sold exclusively through electrical distributors

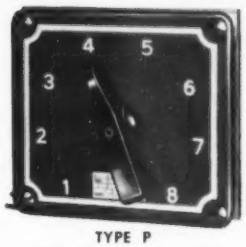


HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by GRAYBAR ELECTRIC COMPANY

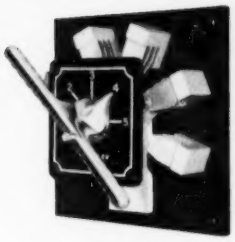
BARKELEW ELECTRIC SWITCHES

TAP SWITCHES



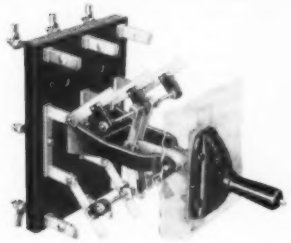
TYPE P
100 AMP. — 8 point

A complete line of manually and motor operated dead front tap switches in capacities from 100 to 2000 amperes continuous rating. Used extensively on resistance welder, electric furnace, transformer, rectifier, control and testing applications.
Available for voltages up to 5000, with 2 to 12 taps, with various types of handles and indexing arrangements, and with auxiliary interlock switiches.
Special switches can be furnished with contacts arranged for series-parallel, star-delta, speed-changing or other requirements.

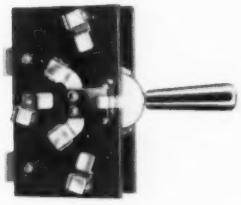


TYPE RH
800 AMP. — 5 point

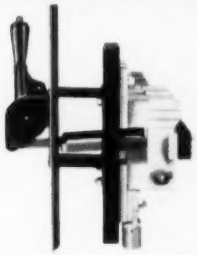
DEAD FRONT SWITCHES



TYPE WAC DEAD FRONT. Mounts behind steel panels. Front panel servicing. 30-3000 amps, 250-600 volt, single or double throw, fusible or not fused, multiple poles.

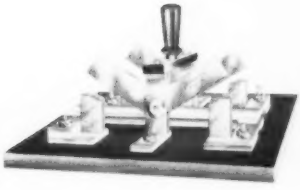


TYPE K heavy duty switch for theatre and television switch boards. Rated 60 amperes at 125 and 250 volts. Also rated 5 H.P. 230 volt A.C. - 250 volt D.C. Colored handles available.



TYPE HA DEAD FRONT. For steel or insulating panels. Rear accessibility. 30-2000 amps. 250-600 volts. Single or double throw. Fusible-non-fusible. Multiple poles.

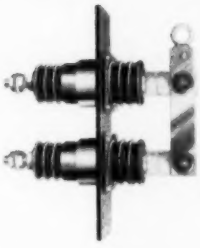
KNIFE SWITCHES



REVERSE POLARITY SWITCHES used in electro-plating. Available in 100 to 8000 amperes at 15 volts D.C. With front or back connections.



OPEN KNIFE 30-10,000 amps. 125-600 volts front or back connections, mounting optional single or double throw, multiple poles, not fused or fusible. Accessories.



TYPE F DISCONNECTING 1200-2000 amps, 5000-7500 volts front or back connections, optional. Latch prevents opening under short circuits.

Literature on these and other BARKELEW Switches available on request.

PRECISION ELECTRIC SWITCHING EQUIPMENT SINCE 1900

BARKELEW ELECTRIC MFG. CO.
MIDDLETOWN, OHIO

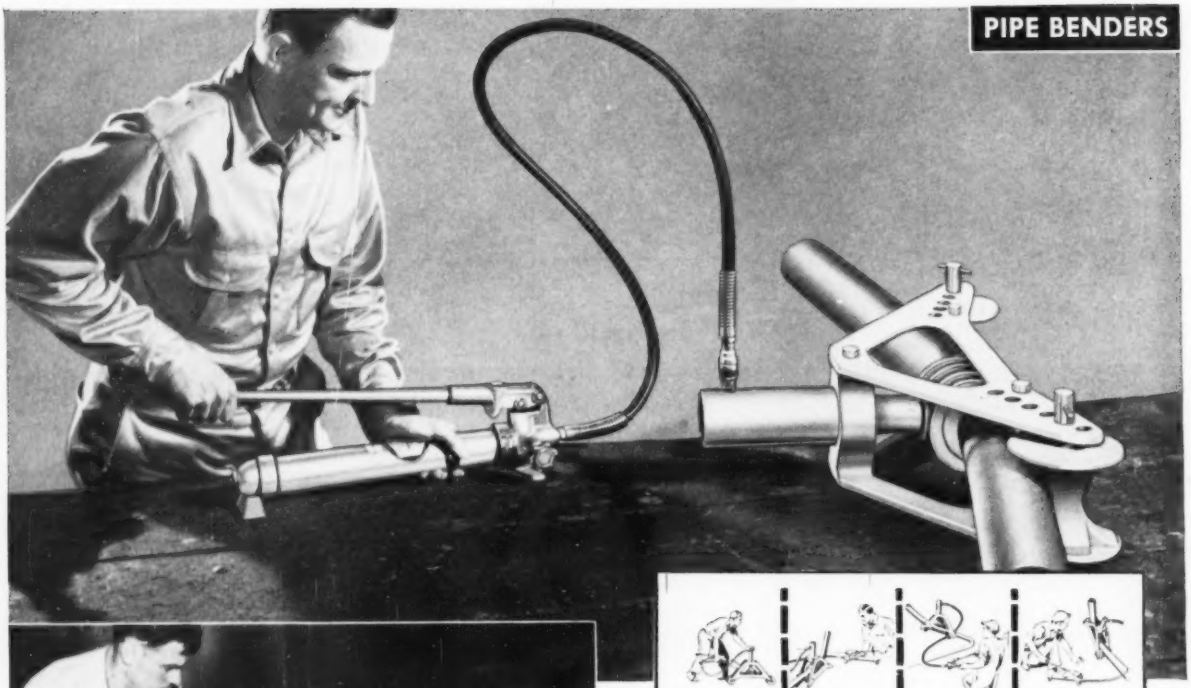


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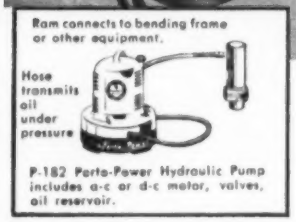
Distributed by Graybar

Blackhawk Hydraulic ease, speed and

PIPE BENDERS







These BENDERS are just plain handier and really portable

There's a *tremendous difference* in pipe benders and the big differences are caused mainly by the design of the hydraulic unit! With a Blackhawk "Porto-Power" Bender, you're not stuck with having to pump from one spot. The hydraulic pump is *separated* from the ram by a flexible safety hose . . . allowing the operator to stand *anywhere*.

The Bender works in any position — on its side or upright . . . on table or floor . . . on existing runs. A man can move around, "jockey" the pipe with one hand — sight along it if necessary . . . without stopping the pumping. You can get Blackhawk Benders to handle all popular sizes of conduit — rigid and thin-wall.

ELIMINATES HAND PUMPING!

Blackhawk's low-cost, motor-driven, portable P-182 pump can replace a hand pump on benders or other hydraulic equipment. It cuts manual effort, *triples* output. Especially effective for repetitive bends or heavy pipe. Users report labor costs less than 25% of charge for "factory bending."



HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

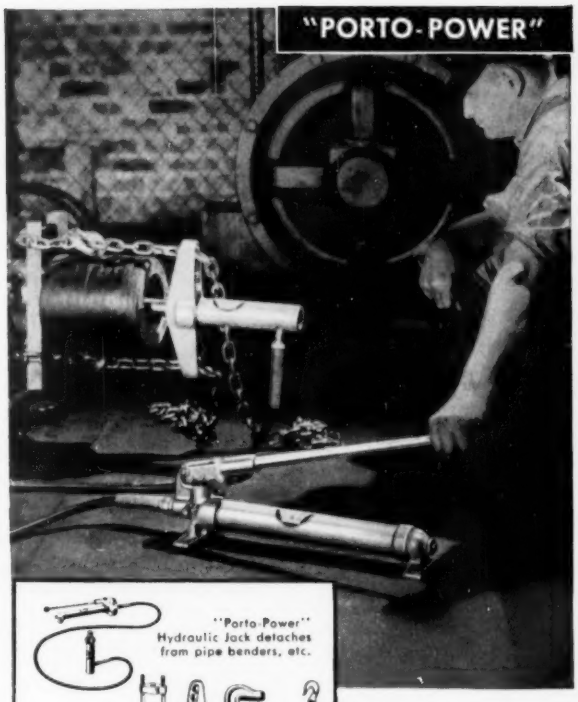
Distributed by Graybar Electric Company

Tools bring spectacular profit to electricians



DRIVE KNOCK-OUT PUNCHES THIS *HYDRAULIC* WAY!

Look! No wrench to swing. No knuckle busting. No more distorted boxes. Now the amazing "Porto-Power" hydraulic jack also drives knock-out punches. It's 60% faster! Conduit openings are *neat* — workmen are happier, safer — dies last up to six times longer! Low-cost kits.



PULL PULLEYS, LIFT MACHINERY, LICK 1001 JOBS

The same "Porto-Power" hydraulic jacks that serve Blackhawk Electrician's Equipment lick dozens of allied jobs. "Porto-Power" wipes out scores of time-wasting construction and maintenance methods. And, it's another big reason why electricians get much more for their money when they buy *Blackhawk* Benders and Knock-Out Punch kits.

Speed-minded contractors and crews are changing to BLACKHAWK

Contractors discover that men are happier when they have Blackhawk Hydraulic Equipment. It's no secret that crews who have choice of all types of benders, prefer Blackhawk. Workmanship is better, too. One good job can more than pay for *any one* of these Blackhawk Hydraulic Tools. Sold by leading Industrial Supply Distributors and Electrical Wholesalers.

BLACKHAWK®
HYDRAULIC TOOLS • HAND TOOLS

CLIP THIS COUPON
for free folder on these remarkable Hydraulic Tools!



BLACKHAWK MFG. CO.
Dpt. P-2043, Milwaukee 1, Wis.

Please send me free 50B folder on Blackhawk Electrician's Equipment.

Name.....

Firm.....

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City.....Zone.....State.....



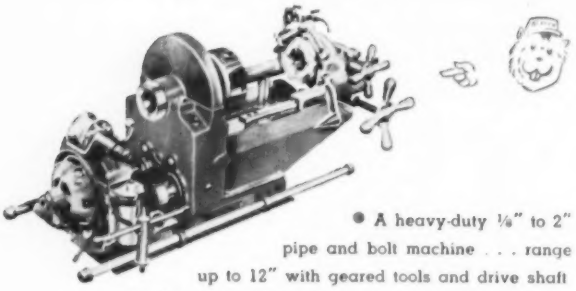
HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by GraybaR

BEAVER PIPE and BOLT MACHINES . . . *SAVE YOU TIME AND MONEY ON THE JOB!*

THE BEAVER MODEL-A HEAVY-DUTY PORTABLE PIPE AND BOLT MACHINE

RANGE: 1/8 to 2 INCHES

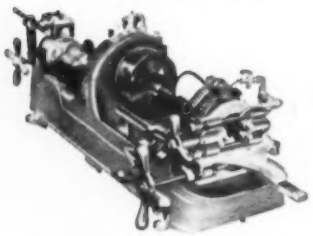


• A heavy-duty ⅛" to 2" pipe and bolt machine . . . range up to 12" with geared tools and drive shaft Leader in its field for the past 20 years. Weight, 365 lbs.

• • •

THE BEAVER MODEL-B PORTABLE UTILITY PIPE AND BOLT MACHINE

RANGE: 1/8 to 2 INCHES

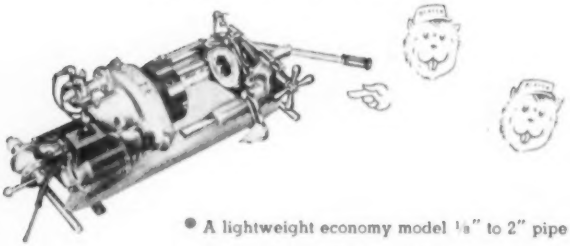


• A medium weight utility model ⅛" to 2" pipe and bolt machine — range up to 8" with geared tools and drive shaft. Aluminum body Weight, 235 lbs.

• • •

THE BEAVER MODEL-E, LIGHTWEIGHT ECONOMY MODEL, PORTABLE PIPE AND BOLT MACHINE

RANGE: 1/8 to 2 INCHES



• A lightweight economy model ⅛" to 2" pipe and bolt machine—range up to 8" with geared tools and drive shaft. Welded base. Weight, 185 lbs.

• The precision built line of Beaver Pipe and Bolt machines is backed by more than 50 years experience and "know how" in the manufacture of high quality tools. Beaver products have justly earned acceptance by electrical contractors, who know from experience that trouble-free performance means time and money saved on the job.

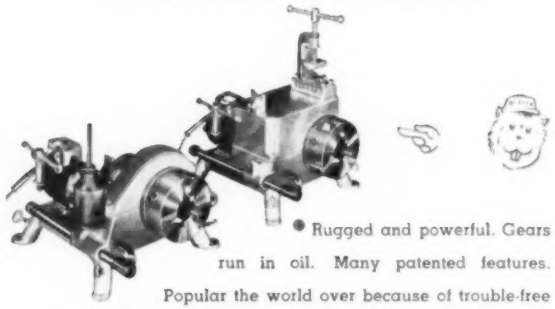
Compare these advantages: The gears run in oil for longer life; a chuck that really holds; right-hand operation like a lathe; a powerful Universal motor; outboard pipe support that prevents whip; a reversible oil pump; quick-opening die heads and many other special features.

It will pay you to investigate the full line of Beaver Pipe and Bolt machines. Write for new catalog and service bulletin for complete information on other Beaver tools.

BEAVER PIPE TOOLS

282-300 DANA AVENUE WARREN, OHIO, U. S. A.

THE BEAVER MODELS C1 and C2 PORTABLE POWER UNITS



• Rugged and powerful. Gears run in oil. Many patented features. Popular the world over because of trouble-free performance. Made in two models.



HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by Graybar Electric Company

try BRADY QUIK-LABEL WIRE MARKERS on your job!



ELIMINATE

- X GUESS WORK
- X RINGING OUT
- X NOTCHING
- X TAGGING

SAVES TIME
SPEEDS UP YOUR WORK

Leading electrical contractors, electricians and maintenance men are now using handy Brady Wire Markers, to mark and identify cables, wires, circuits, leads, switches, etc. They're simple and economical to use, quickly applied, easily read and save hours of time on any job.

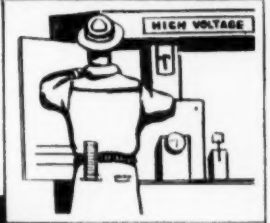
Over 1000 different markers in stock for immediate shipment, including all standard NEMA colors, codes, symbols and numbers. Specials made for your particular requirement.

Brady Quik Labels are self adhesive, stick to any surface without moistening — even when pulled through conduit. They're tough and durable — Silicone coated to resist dirt, grease and grime. Low in cost.

Send for FREE SAMPLES and catalog, today!

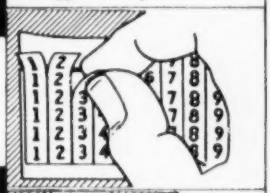
Handy DISPENSER Card

Brady Wire Markers come mounted on handy DISPENSER cards, with an exclusive Starter-Strip permitting fast removal. Cards can be carried in pocket or tool kit.



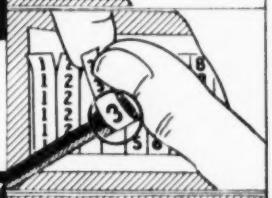
1. PEEL

Pull back Starter Strip and labels peel off in a jiffy. NO SHARP TABS TO CUT FINGERS.



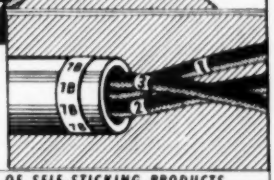
2. APPLY

BRADY MARKERS stick without moistening. Simply wrap around wire and you have positive, permanent identification.



3. IDENTIFY

Thousands of uses and applications. Clear, legible numbers, letters, symbols and colors leave no room for doubt.





WRITE TODAY
FOR FREE CATALOG
AND USABLE SAMPLES

Illustrated catalog that should be in every electrician's file. Shows all Brady QUIK-LABEL products, and helpful, time saving ideas. Actual, useable samples included.

DISTRIBUTED IN LES PRINCIPAL CITIES

WIRE MARKERS
PIPE MARKERS
SAFETY SIGNS
PRINTED SCOTCH-TAPE
MASKS & STENCILS

MANUFACTURERS OF SELF-STICKING PRODUCTS

W. H. BRADY COMPANY

EST. 1914

752 W. Glendale Ave., Milwaukee 12, Wis.



HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by GraybaR ELECTRIC COMPANY

hydraulic power for quick, economical connections anywhere



FOOT OPERATED HYPRESS*

BURNDY

lightest tools



HYDENT CONNECTORS...

Listed by Underwriters' Laboratories in all sizes — #22 through 2,000 Mcm.

Recommended for hydraulic tooling from #9 through 2,000 Mcm.

HYLUGS and HYLINKS

One piece, pure copper, tubular construction. Indent on any side of barrel. Can't split. No intermediate contact surfaces, current carried by entire cross-section. Plated to resist corrosion. Ask for Catalog Y53B.

HYCRAB

Insulated multiple connector. Most economical method of joining cables in underground networks. Ask for Catalog Z47B.

*Air or electrical driven units can replace foot pump where required

electrical connectors and installation tools by...



HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by GrayBaR

HYPRESS

per ton of delivered force

HYDENT INSTALLATION...

A time saving, money saving method of making permanent, uniform connections faster. Made feasible for general use when Burndy developed portable hydraulic installation tooling 15 years ago. Better connections assured by intimate, high pressure contact between connector and conductor. Quickly interchangeable dies permit each tool to be used over wide range of conductor sizes.



MANUAL HYPRESS

CONSTRUCTION

WIRING

Cost comparison was made recently on a construction job involving 160 connections for wire of average size. The savings on Hydent connectors (against cast connectors) more than paid for the Hypress. On future jobs this contractor will save over 80% of his former connector cost. Even against the most economical type of bolted connector, savings would average 40%-50%.

MODERN TOOLING

"A 9-lb. tool with a 9-ton bite" makes the manual Hypress a favorite everywhere. Rotating head through 90°. Neoprene insulated as a protection against short circuits.

For maneuverability in cramped quarters—for indenting pressures to 80,000 lbs. and for wire or cable through 2,000 Mcm—the foot operated Hypress is predominant. Swivel jointed flexible high pressure hose permits use at any angle.

92-13

BURNDY ENGINEERING COMPANY

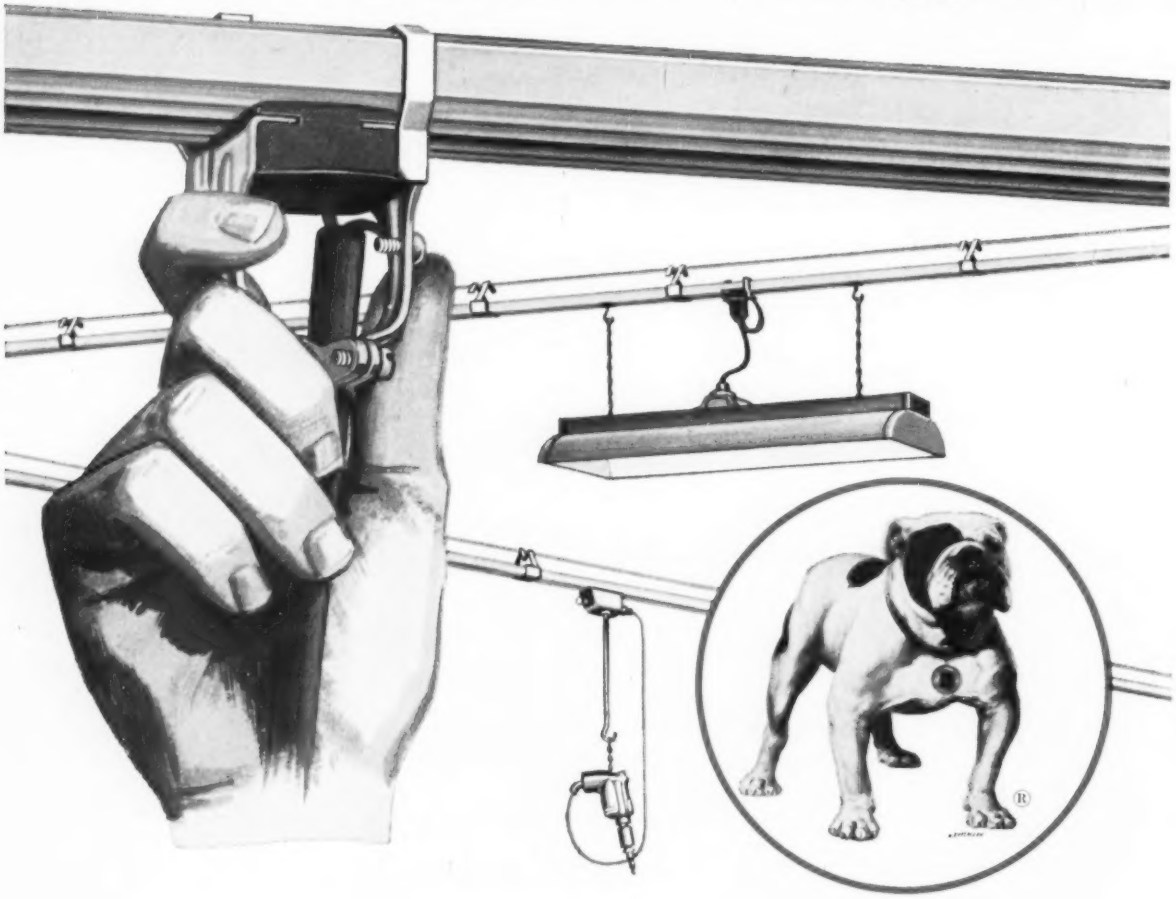
NORWALK, CONNECTICUT • BURNDY CANADA, LTD., Toronto 8, Ontario



HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by GRAYBAR

BullDog UNIVERSAL *Trol-E-Duct*



Lighting on the spot

Another BullDog Thoroughbred Product — Universal Trol-E-Duct is a small-sized, economical duct system that lets you add and relocate lighting fixtures or electric hand tools . . . in seconds.

When lighting needs change, Twist-Out Plugs come out with a flick of the wrist and reinsert *anywhere* along the duct without time-wasting shut-downs. For mobile tools, trolleys are available that ride the track inside the duct . . . they let the tool follow the job.

The rigid steel duct encasing the solid-copper bus bars is simple to install and rugged in use — it will support even the heavier lighting fixtures. The entire system is completely prefabricated . . . can be dismantled and installed *anywhere at any time* without loss of material. The only tool needed is a screw driver!

BullDog Universal Trol-E-Duct has a wide range of commercial and industrial uses. Write today for free Bulletin UT-650 for complete details. BullDog Electric Products Company, Dept. EC-43, Detroit 32, Mich.

©BEPCO

BULLDOG
ELECTRIC PRODUCTS COMPANY



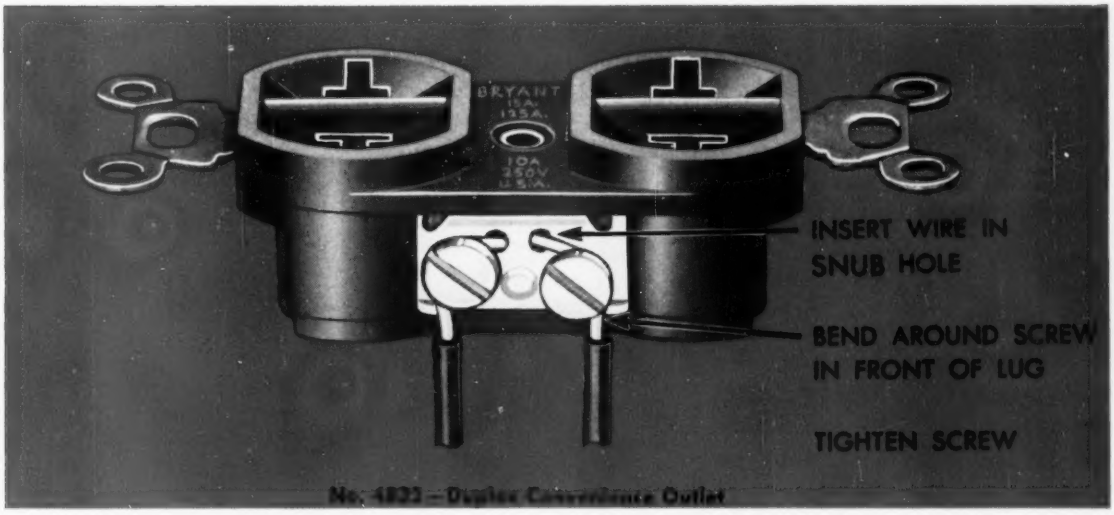
HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by GraybaR

Fastest, easiest, most secure way to attach conductors

THE ANSWER IS
BRYANT
WIRING DEVICES

New "Hole-Snub" Wiring



No. 4823 — Duplex Convenience Outlet

ADDITIONAL FEATURES —

- Device has staked terminal screws-backed out
- Large head screws permit use of wire up to and including No. 10
- Double-sided contacts
- "T" Slots
- All-plastic body available in brown and ivory

Specify Bryant from your Electrical Distributor

Listed by Underwriter's Laboratories, Inc.

BRYANT
SUPERIOR WIRING DEVICES

THE BRYANT ELECTRIC COMPANY

Bridgeport 2, Connecticut

Chicago • Los Angeles

J-99887



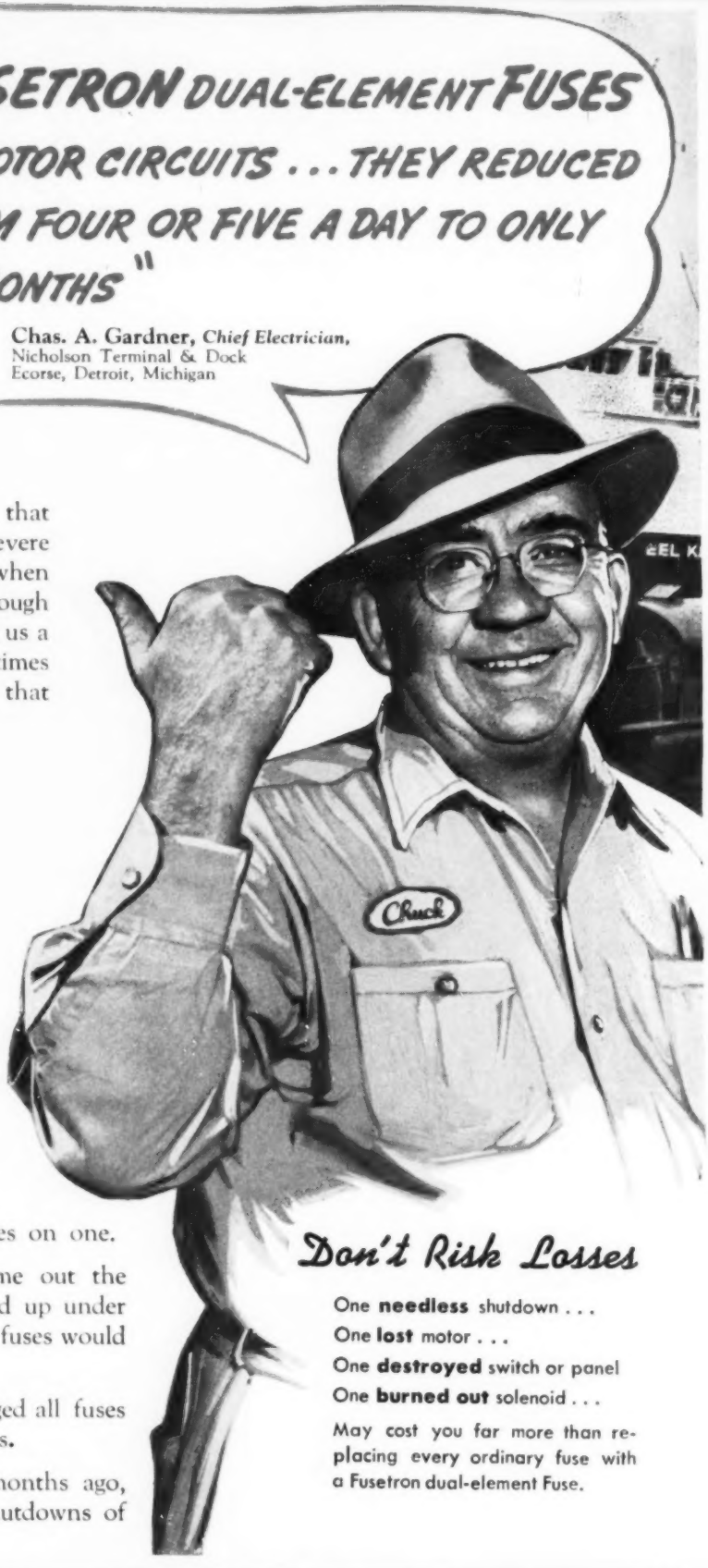


HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by GRAYBAR

"We tried FUSETRON dual-element FUSES on our crane motor circuits . . . they reduced fuse blows from four or five a day to only three in seven months"

Chas. A. Gardner, *Chief Electrician,*
Nicholson Terminal & Dock
Ecorse, Detroit, Michigan



PROBLEM

"We have many overhead cranes that operate on 24 hour schedules. The severe service to which these cranes are put when loading and unloading ships throws a tough load on the motors. This was causing us a lot of grief due to fuses blowing 4 or 5 times a day. Each blow caused a shutdown that stopped work and made men idle.

SOLUTION

"In testing Fusetron fuses to see if they would help us, we selected a certain crane and inserted Fusetron fuses in that circuit for one 8 hour shift. At the end of the shift we would replace the Fusetron fuses with the ordinary renewable fuses we had formerly used. Then we compared the down time of the crane due to fuse blows.

"To be sure the fuse blows weren't due to the operator, we changed around and would run the Fusetron fuses on two shifts and the old fuses on one.

"The results, however, always came out the same. The Fusetron fuses would stand up under the hard service — and the ordinary fuses would not.

"As a result of these tests we changed all fuses on our crane circuits to Fusetron fuses.

"That was last October, seven months ago, and to date we have had only 3 shutdowns of our cranes due to fuses blowing."

Don't Risk Losses

One **needless** shutdown . . .
One **lost** motor . . .
One **destroyed** switch or panel
One **burned out** solenoid . . .

May cost you far more than replacing every ordinary fuse with a Fusetron dual-element Fuse.



HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by GraybaR



FUSETRON dual-element FUSES Protect Production *10* Ways

1 *Protect against short-circuits.

2 Protect against needless blows caused by harmless overloads.

3 Protect against needless blows caused by excessive heating—lesser resistance results in cooler operation.

4 Provide thermal protection—for panels and switches against damage from heating due to poor contact.

5 Protect motors against burnout from overloading.

6 Protect motors against burnout due to single phasing.

7 Give DOUBLE burnout protection to large motors — without extra cost.

8 Make protection of small motors simple and inexpensive.

9 Protect against waste of space and money — permit use of proper size switches and panels.

10 Protect coils, transformers and solenoids against burnout.

*Fusetron Fuses have high interrupting capacity as shown by tests of the Electrical Testing Laboratories of New York.

HERE'S WHY...

A fuse link combined with a thermal cutout — the result, a fuse with tremendous time-lag and much less electrical resistance.

They have the same degree of Underwriters Laboratories approval for both motor-running and circuit protection as the most expensive devices made.

Made to same dimensions as ordinary fuses, FUSETRON FUSES fit all standard fuse holders.

Obtainable in all sizes from 1/10 to 600 ampere, both 250 and 600 volt types. Also in plug types for 125 volt circuits.

Their cost is surprisingly low.

FUSETRON is a trade mark of the Bussmann Mfg. Co.

Bussmann Mfg. Co., University at Jefferson,
St. Louis 7, Mo. (Division of McGraw Electric Co.)

Please send me complete facts about FUSETRON dual-element Fuses.

Name _____

Title _____

Company _____

Address _____

City & Zone _____ State _____ ECM 4-53



HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Graybar Distributed by Graybar

FOR USE IN FOUNDRIES, STEEL MILLS, SHOPS, FACTORIES, GYMNASIUMS AND OTHER HI-BAY AREAS

Die-cast Socket Housing

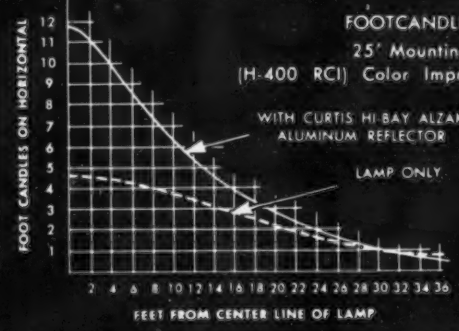
Ventilated to permit lamp operation at recommended temperatures . . . longer lamp life.



Alzak Aluminum Housing prevents moisture from coming in contact with lamp . . . eliminates lamp breakage.

Alzak Aluminum Housing incorporates "flared reflector skirt" which redirects to the working area 30% to 40% of the light of the mercury lamp which is normally wasted in upper areas.

NEW CURTIS HI-BAY R LAMP UNITS



WRITE FOR BULLETIN No. 2424

CURTIS LIGHTING, INC.

6135 West 65th Street, Chicago 38, Illinois



HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by GraybaR

users prefer COFFING HOISTS

. . . for multiplying manpower

Wherever a load must be lifted, pulled, skidded, stretched, moved, or bound, there is a right Coffing Hoist to take over the heavy work, speed the job, and in many cases, enable one man to replace a crew.

. . . increased safety

You can depend on Coffing Hoists to protect men and equipment. Each is designed and built to operate efficiently at full rated capacity with a wide margin of safety.

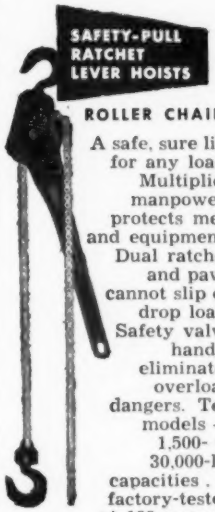
. . . saved maintenance costs

Coffing Hoists stay on the job longer because they require less maintenance attention. Prompt Coffing service and immediate shipment of replacement parts further reduces delays and down time. Down-time costs saved and repair costs saved are profits earned.



QUIK-LIFT ELECTRIC HOISTS

Ruggedly built for the most continuous assembly line use. For long life, all moving parts are sealed, running in oil. For safety, parts are tested at 100% overload. Seventeen models — 500 to 4000-lb. capacities.



SAFETY-PULL RATCHET LEVER HOISTS

ROLLER CHAIN

A safe, sure lift for any load. Multiplies manpower, protects men and equipment. Dual ratchet and pawl cannot slip or drop load. Safety valve handle eliminates overload dangers. Ten models — 1,500- to 30,000-lb. capacities . . . factory-tested at 100 percent overload.



COIL CHAIN

The new Model R Ratchet Lever Hoist features Coffing's time-proved Safety-Pull ratchet-pawl construction — plus coil chain for extra flexibility. Chain wraps in any direction . . . resists rust and corrosion. For ease of servicing, the Model R may be completely disassembled in seconds with only a screw driver. For safety, each unit is tested at 100 percent overload. Two models—1,500- and 3,000-lb. capacities.



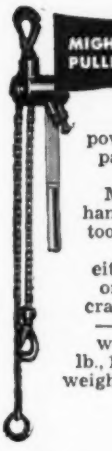
HOIST-ALL

A handy all-around tool for hoisting, lifting, pulling. Without its stand, it is an efficient hoist, puller, or load binder. With stand, it becomes a powerful high-lift jack. Two sizes — 2,000 and 4,000-lb. capacities.



CHALLENGER SPUR GEAR HOISTS

All-steel, yet weighs only 39½ lb. Housing does not crack under impact. Back plate is laminated for greater rigidity. Permits minute load adjustment. Hoist can be completely disassembled in minutes with ordinary tools. Capacities, ½-, 1- and 2-ton all tested at 100 percent overload, safety factor of five. For heavy duty, *Model YC* ball-bearing hoists — Seven sizes, ½- to 5-ton capacities. *Model YCT* — Timken-bearing hoists. Fifteen sizes, ¼ to 25 tons.



MIGHTY-MIDGET PULLERS

Big pulling power in a small package. Light, compact, a Mighty-Midget hangs easily on a tool belt. Handle can be used either as a lever or a high-speed crank. Two sizes — 500-lb. model weighs only 6½ lb., 1,000-lb. model weighs only 9½ lb.



HOIST-BINDER

Ratchet hoist principle allows continuous take-up without releasing hook for new grab. Handle may be removed, making binder a tamper-proof lock. Weighs only 10 lb., exerts 3,000-lb. pull.



SAFETY LOAD BINDERS

Dual ratchet and pawl hold securely. Handle cannot fly up when released. Two models — 3,000- and 6,000-lb. capacities.



I-BEAM TROLLEYS

Plain or geared types. Capacities up to 10 tons.

Dept. EC

COFFING HOIST COMPANY

Danville, Illinois





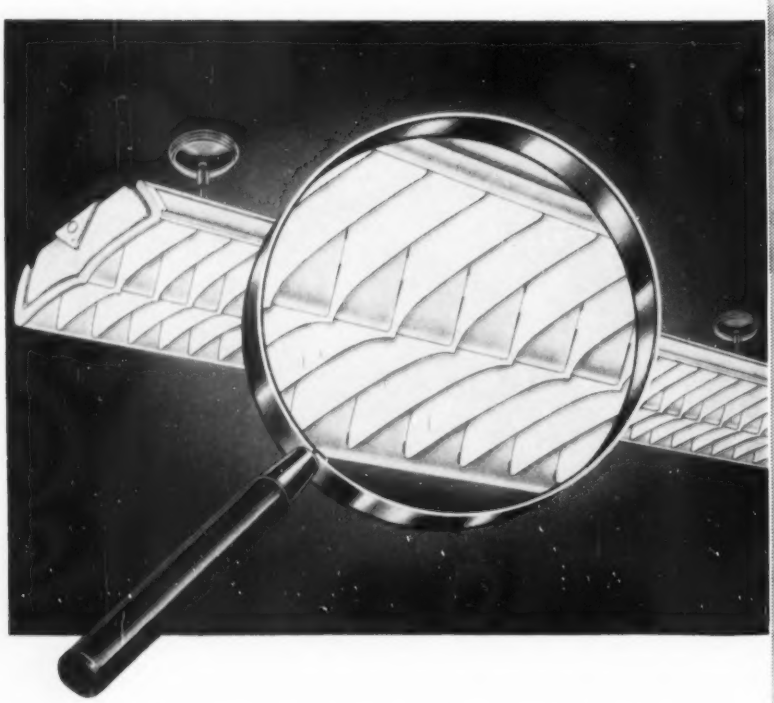
HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by GraybaR

Day-Brite "Close-Up" Quality

GIVES YOU EXTRA VALUE

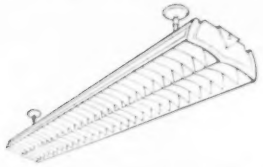
to put into your lighting specifications



THIS IS A CLOSE-UP of the *interlocking louver* feature of Day-Brite's LUVEX fixtures. Each crosswise louver is firmly locked in the center "V" louver and both side rails. The whole shielding unit is rigid. It won't sag. It won't rattle. Louvers will not twist or bend out of shape while the fixture is being cleaned.

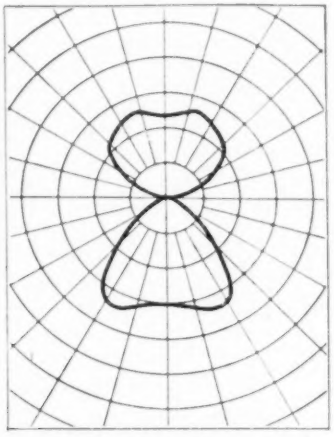
IT IS IMPORTANT for you to know about this "close-up" quality feature. It is one of many reasons you specify *extra value* when you specify LUVEX.

DAY-BRITE'S LUVEX®
...84% EFFICIENT



There must be reason for LUVEX's enthusiastic acceptance among lighting men from coast to coast. There must be reason for the great sales records this Slimline series has made during the past two years.

ONE REASON IS EXTREMELY HIGH EFFICIENCY—the result of years of planning and engineering before LUVEX reached the market.



THE TWO LIGHT LUVEX with standard 35/25 cut-off (curve shown above) has an overall efficiency rating of 84.1%. The four light LUVEX with standard cut-off rates even higher at 86.8%—a truly remarkable performance.

A new LUVEX bulletin has just been prepared. For the complete LUVEX story write today for bulletin OD-572.

* * *

Day-Brite Lighting, Inc., 5432 Bulwer Ave., St. Louis 7, Missouri. In Canada: Amalgamated Electric Corp., Ltd., Toronto 6, Ontario.

"DECIDEDLY BETTER"
DAY-BRITE
Lighting Fixtures



HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Graybar Distributed by Graybar

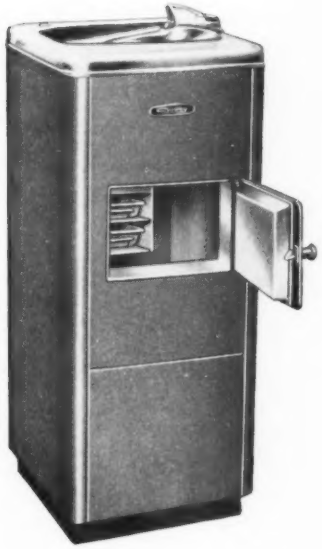
Cordley
NEW YORK

DRINKING WATER COOLERS

Electric

IT'S NEW

COOLER SENSATION FOR 1953



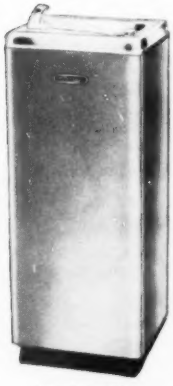
Now for the first time anywhere, you can have a BIG combination bubbler-type water cooler and refrigerator that will

1. serve cold water to 50 or more workers per hour
2. cool about 1 cubic foot of lunches, milk, soda pop, etc. to refrigerator temperatures
3. freeze about 3½ lbs. of ice cubes

ALSO AVAILABLE ARE 17 OTHER MODELS OF CORDLEY ELECTRIC WATER COOLERS FOR EVERY INDUSTRIAL AND COMMERCIAL NEED



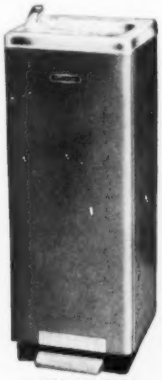
BOTTLE TYPES



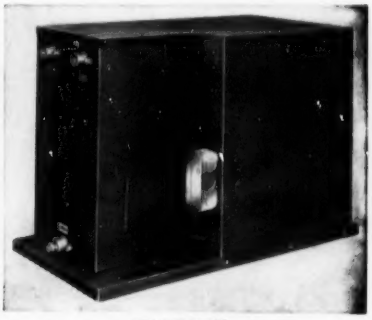
HAND CONTROL



HIGH CAPACITY



FOOT CONTROL



REMOTE TYPES

Cordley Coolers keep you and your workers refreshed and comfortable. They give plenty of good palatably cold drinking water. With Cordley's around your plant and office this summer, you'll have no trouble with the weather.

It isn't too soon to order. Pick up the phone now

5-YEAR WARRANTY

Every user of Cordley Hermetic Electric Water Coolers is protected for a period of five years from the date of installation. This warranty covers replacement of the entire cooler if a defect occurs within the hermetic factory-sealed refrigerant system. Copy of the complete warranty will be supplied upon request.

SINCE 1889 . . . CORDLEY KNOWS HOW . . . OVER 1,000,000 SOLD



HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA
GRAYBAR

GRAYBAR Distributed by GRAYBAR ELECTRIC COMPANY



this **SURE** Protection... in ALL Standard Capacities

Give all your circuits the safe and saving protection of "ECONOMY DE-LAY" Renewable Fuses.

Then whenever you have an electric current "blow", you instantly restore the fuse to its original efficiency by simply inserting an inexpensive "ECONOMY DE-LAY" Renewal Link *in the same cartridge.*

Takes only a minute or two; costs only a few cents!—And you Conserve Precious Brass and Copper.

Your Electrical Wholesaler has "ECONOMY DE-LAY" Renewable Fuses and Renewal Links in stock.

Ask for the Economy Catalog and Price List.

R-5770R

ECONOMY DE-LAY RENEWABLE CARTRIDGE FUSES

© Reg. U. S. Pat. Office

ECONOMY FUSE AND MFG. CO., 2717 GREENVIEW AVE., CHICAGO 14, ILLINOIS REPRESENTATIVES IN ALL PRINCIPAL CITIES



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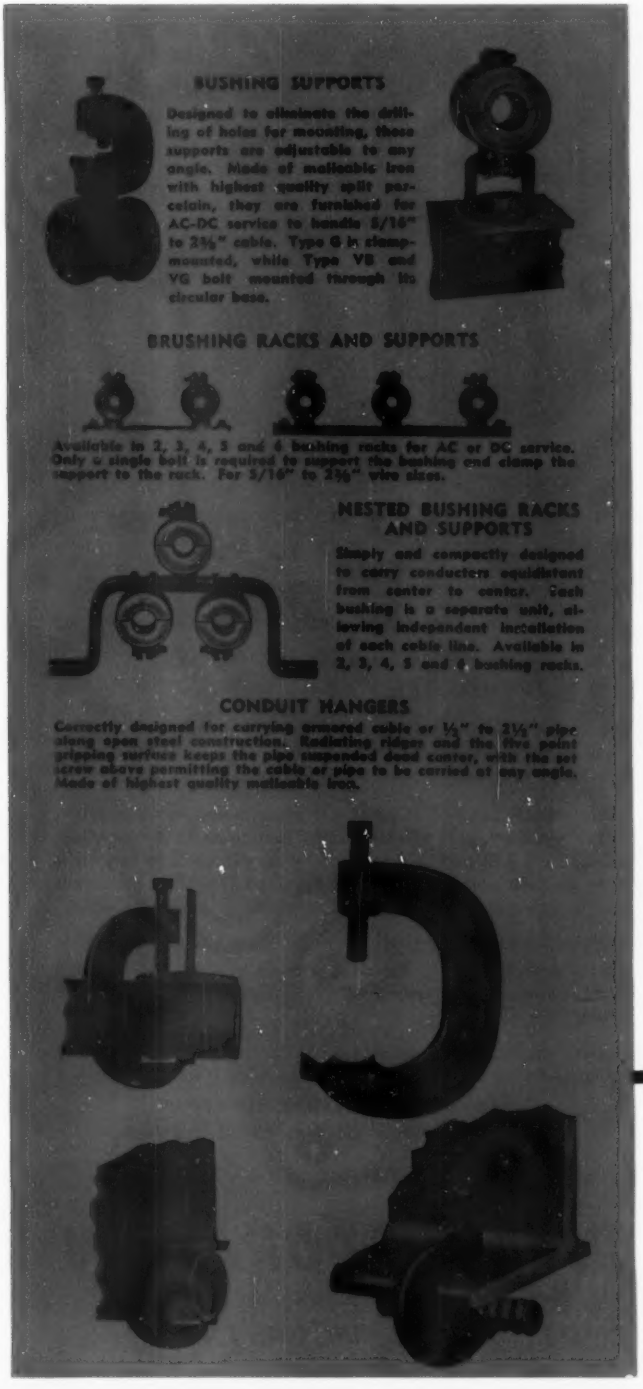
Distributed by Graybar Electric Company

Efficiency

SUSPENSION DEVICES
ARE TIME AND COST SAVERS

By eliminating the need for punching, drilling or burning through beams in order to hang electrical mountings . . . Efficiency Suspension Devices can save you time and expense on practically every construction job. They are ideal for attaching wires, cables, conduits and pipes to most construction forms and surfaces, including structural steel, concrete, brick, hollow tile and wood.

Simple in design and correctly engineered for their service, these devices have been service-proved countless times. Illustrated here are only a few Efficiency Suspension Devices. Complete details are included in the efficiency catalog—gladly sent on request.



BUSHING SUPPORTS

Designed to eliminate the drilling of holes for mounting, these supports are adjustable to any angle. Made of malleable iron with highest quality split porcelain, they are furnished for AC-DC service to handle 5/16" to 2½" cable. Type G is clamp-mounted, while Type VB and VG bolt mounted through its circular base.

BUSHING RACKS AND SUPPORTS

Available in 2, 3, 4, 5 and 6 bushing racks for AC or DC service. Only a single bolt is required to support the bushing end clamp the support to the rack. For 5/16" to 2½" wire sizes.

NESTED BUSHING RACKS AND SUPPORTS

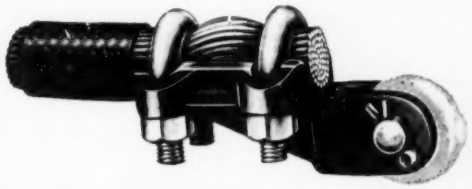
Simply and compactly designed to carry conductors equidistant from center to center. Each bushing is a separate unit, allowing independent installation of each cable line. Available in 2, 3, 4, 5 and 6 bushing racks.

CONDUIT HANGERS

Correctly designed for carrying armored cable or ½" to 2½" pipe along open steel construction. Radiating ridges and the five point gripping surface keeps the pipe suspended dead center, with the set screw above permitting the cable or pipe to be carried at any angle. Made of highest quality malleable iron.

CABLE STRAIN CLAMP

Capable of withstanding a direct pull of over 12,500 lbs. before slipping, this clamp can be furnished either with eye or clevis. Three clamp sizes accommodate all cable sizes from 1/0 to 1,500,000 c.m. Constructed of malleable iron, this clamp has a high ridge across the center of the cable channel and a U-bolt at each end.



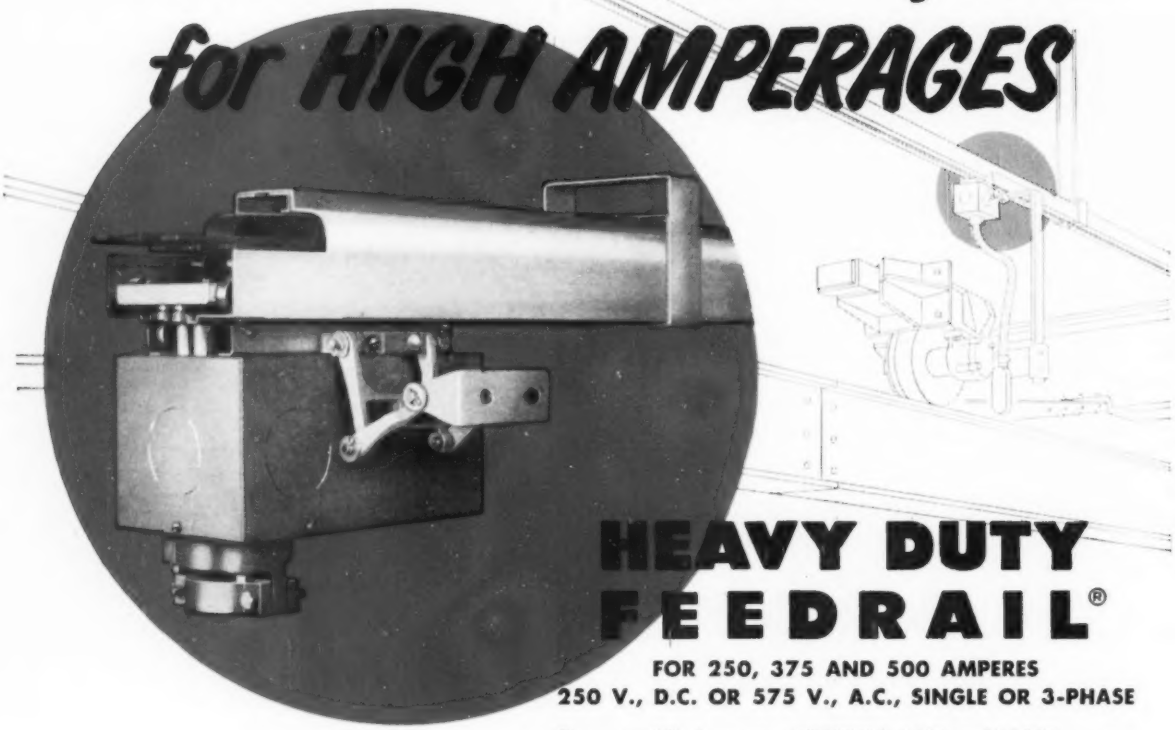
Efficiency
ELECTRIC AND MANUFACTURING COMPANY
Write for Catalog
East Palestine, Ohio



HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by Graybar

NOW—a completely standardized mobile electrification system for HIGH AMPERAGES



HEAVY DUTY FEEDRAIL®

FOR 250, 375 AND 500 AMPERES
250 V., D.C. OR 575 V., A.C., SINGLE OR 3-PHASE

The unqualified success of FEEDRAIL "60" and "100" ampere systems of mobile electrical distribution has led to many requests for the same system in higher amperages.

These were formerly handled on a "special order" basis. Now, as the result of years of satisfactory service and the heavy demand, 250, 375 and 500 ampere "Heavy Duty" Systems have been made a part of the regular Feedrail line. They are available in standardized track sections, trolleys and accessories.

"HEAVY DUTY" FEEDRAIL is not an adaptation of a lighter capacity system. Every one of its standardized components is designed and proportioned expressly for high amperage and heavy duty service.

Existing applications include freight car icing machines — big tonnage hoists and cranes — large machine tools, etc.

Write for descriptive literature
Sold by leading electrical distributors

HEAVY DUTY FEEDRAIL FEATURES

MAXIMUM SAFETY—*Enclosed conductors eliminate dangers of exposed wiring.*
EASE OF INSTALLATION—*Standardized units fit together easily. No special tools are needed.*
ADAPTABILITY—*Easy to extend, modify or move reusing all components of existing system.*
MOBILITY — *Trolley power outlets move with the electrical load.*
LOW MAINTENANCE—*Simple periodic cleaning and lubrication is all that's needed.*

52-S Rev.

ELECTRIC FEEDRAIL®

Never Becomes Obsolete

FEEDRAIL CORPORATION

Subsidiary of Russell & Stoll Company, Inc.

125 BARCLAY STREET • NEW YORK 7, N. Y.

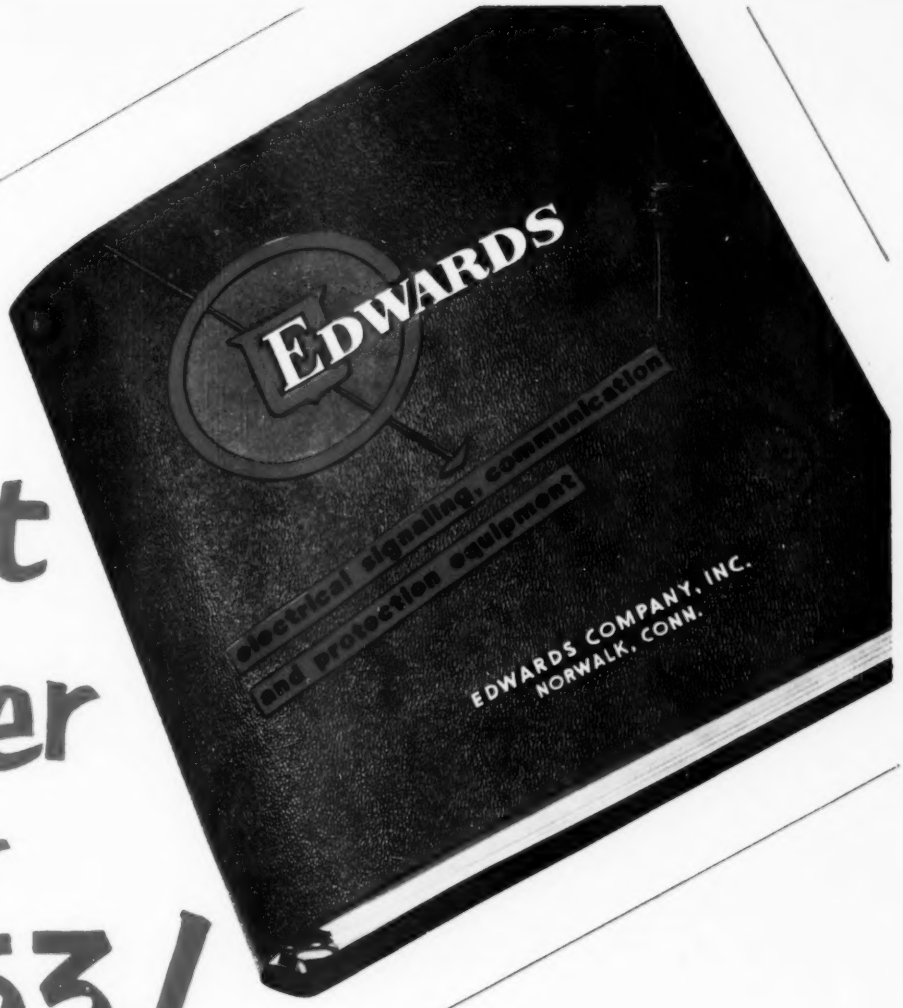
SPECIALLY QUALIFIED REPRESENTATIVES IN PRINCIPAL CITIES



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Distributed by GRAYBAR ELECTRIC COMPANY

Best Seller for 1953!



It's Edwards new 1953 catalogue . . . and it's "must" reading for every electrical contractor, maintenance man and distributor.

Covers all the best-selling electrical signaling devices—bells, buzzers, contact devices, transformers . . . and complete Edwards systems. All streamlined for easy reading and reference.

Here's one more example of Edwards continued cooperation with distributors, installers and users of dependable Edwards equipment. If you haven't received your copy, write today. We'll send it promptly. Edwards Company, Inc., Dept. EC-4, Norwalk, Conn.

EDWARDS

... Complete protection for Distributors
... Ease of installation for Contractors
... Greater service and satisfaction for Users

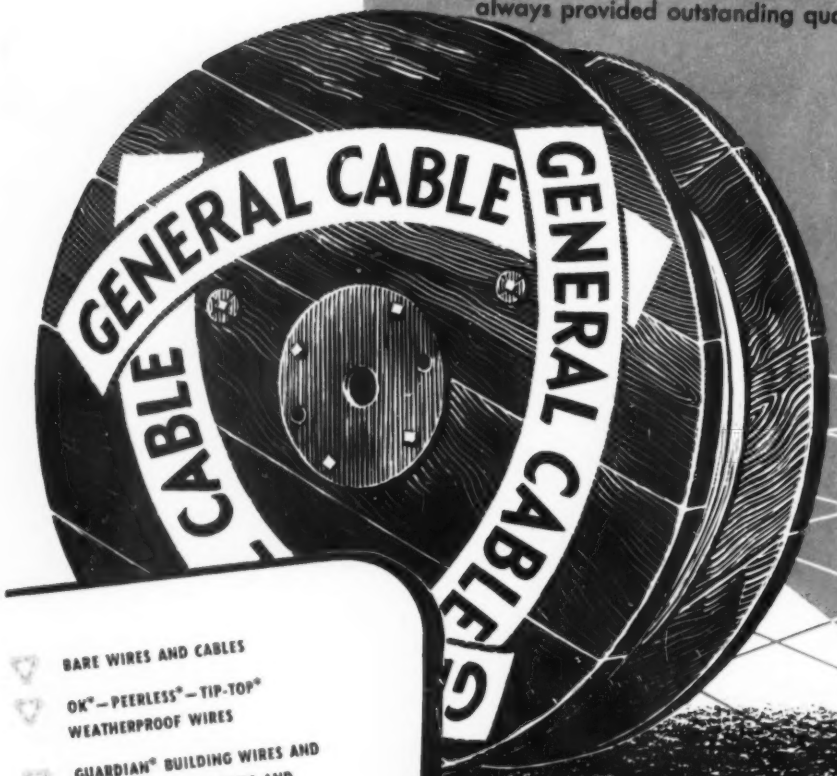


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TEAMED UP FOR SERVICE...

Only a complete line of the best that engineering experience and performance can produce is adequate to meet the demands of our customers. This means, every company on our team must maintain manufacturing standards of the highest order. Such has been the achievement of General Cable—whose wire and cable products have always provided outstanding quality and performance.



- BARE WIRES AND CABLES
- OK*—PEERLESS*—TIP-TOP* WEATHERPROOF WIRES
- GUARDIAN* BUILDING WIRES AND CABLES—THERMOPLASTIC AND RUBBER INSULATED
- ROMEX*, ROMEX-G AND ROMEX-N NON-METALLIC SHEATHED CABLES
- VARNISHED CAMBRIC POWER AND CONTROL CABLES, THERMOPLASTIC AND THERMOSETTING JACKETED, BRAIDED, OR LEAD SHEATHED
- SUPER SERVICE AND OTHER PORTABLE CORDS AND CABLES
- SERVICE CABLES—ALL TYPES

* TRADE MARKS REG. U. S. PAT. OFF

"More Power to You"

GENERAL CABLE
CORPORATION

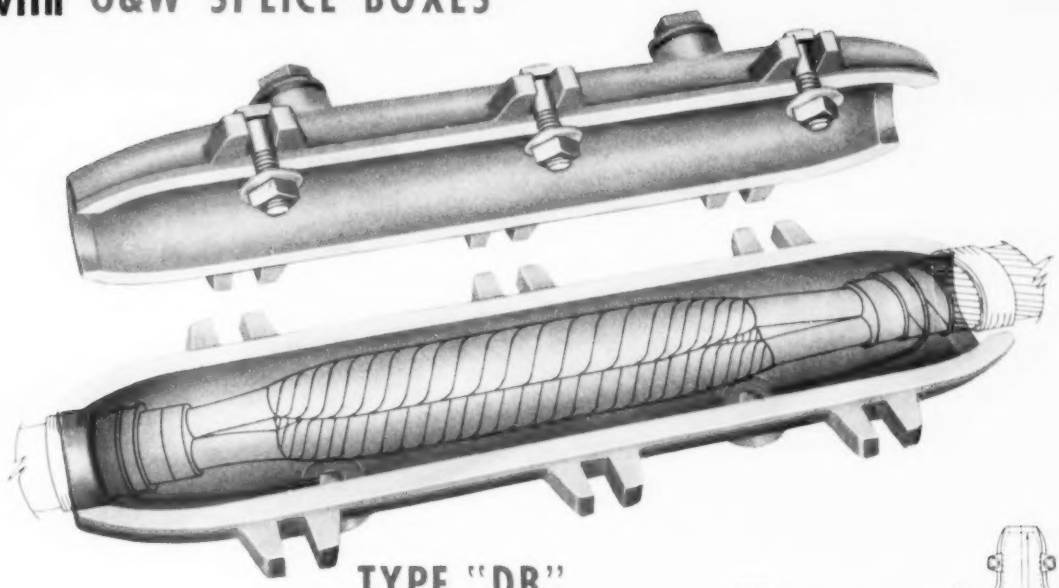
EXECUTIVE OFFICES: 420 LEXINGTON AVENUE, NEW YORK 17, N. Y.
SALES OFFICES IN PRINCIPAL CITIES OF THE UNITED STATES



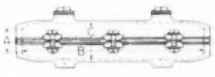
HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by GRAYBAR ELECTRIC COMPANY

Protect your CABLE JOINTS with G&W SPLICE BOXES

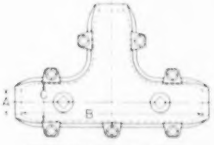


TYPE "DB"



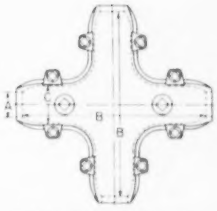
TWO WAY—STRAIGHT

4 Sizes	Dimensions" A	B	C
#DB2102	1¼	10	2
#DB2153	2	15	3
#DB2204	2¾	20	4
#DB2255	3½	25	5



THREE WAY—TEE

3 Sizes	Dimensions" A	B	C
#DB3102	1¼	10	2
#DB3153	2	15	3
#DB3204	2¾	20	4



FOUR WAY—CROSS

2 Sizes	Dimensions" A	B	C
#DB4102	1¼	10	2
#DB4153	2	15	3

Type "DB" Splice Boxes are split lengthwise in identical halves clamped together with galvanized steel bolts. These cast iron splice boxes are primarily intended for protecting lead sleeve joints on armored cables buried in the ground. They are frequently used for enclosing joints without lead sleeves.

The top half has large filling holes (with gasketed plugs) for compounding. The bottom half has screws on inside of bosses for bonding metallic cable coverings.

The matching surfaces of the two iron castings are ground smooth for a good tight seam.

The box end openings (cast to diameters "A" listed) are sealed by clamping the cables which are wrapped with anhydrous tape to make a snug fit. (See below.)

Send for your copy of G & W Bulletin BA52 listing CABLE BOXES.



Lead or Neoprene



Steel Tape Armor



Interlocking Armor

G & W ELECTRIC SPECIALTY CO.

7780 Dante Avenue • Chicago 19, Illinois

Cable Terminating, Connecting and Sectionalizing Devices

Representatives in principal cities of U.S.A.

In Canada—Powerlite Devices, Ltd., Toronto, Montreal and Vancouver

Also sold through your regular Electrical Distributor



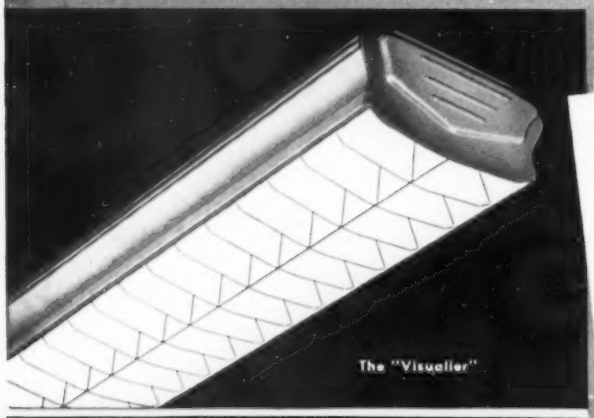
HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

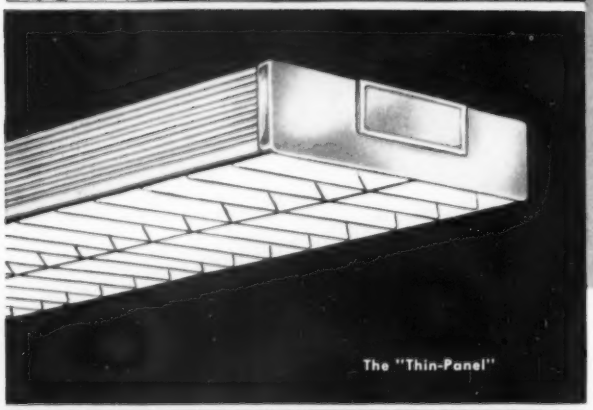
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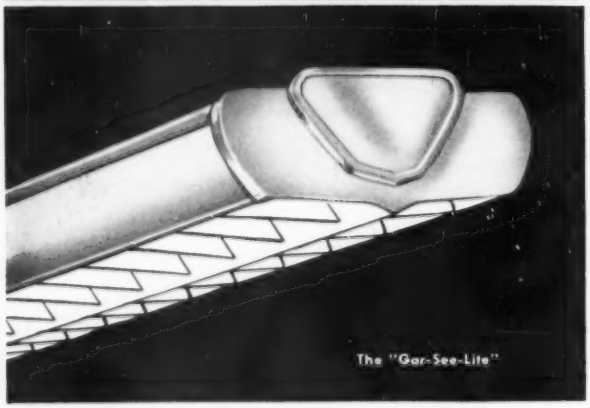
Wherever Budget-Rated Lighting is called for . . .

Call for

GARCY'S BIG 3









1. **The "Visualier"** . . . the aristocrat of the Garcy line . . . long recognized as the finest in school and office lighting. Has illuminated sides and 45° x 45° shielding. Recommended where the customer wants the finest in appearance, quality and efficiency.

2. **The "Thin-Panel"** . . . graceful design and high-quality construction at a moderate price . . . ideal for stores and offices. Plastic or metal side panels, 2-lamp or 4-lamp units, fluorescent or slimline.

3. **The "Gar-See-Lite"** . . . probably the lowest priced *quality* fixture on the market today. Most versatile, too, with a choice of plastic, illuminated metal or opaque metal side panels, 2-lamp or 4-lamp units, fluorescent or slimline.

In addition—here are other popular Garcy fixtures for a wide range of lighting applications . . .



TROFFERS: 1, 2 or 3 lamp rows, 4, 6 or 8 ft. lengths. Louvered, glass-bottom, or lens.



CIRCULUX: for silvered bowl lamp. Surface, recessed or pendant mounted types.



INCANDESCENT Units Swivel display, recessed, pendant hanging, and Spot-a-Lites.



ADDA STRIP for slimline or fluorescent lamps. Lengths 18 inches to 96 inches.



New Garcy Lighting Catalog Ready Now! Write for Free Copy

GARDEN CITY PLATING & MFG. CO.

1730 NORTH ASHLAND AVENUE
CHICAGO 22, ILLINOIS



HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by Graybar

STOP costly blink-blink-blink

WITH G-E WATCH DOG NO-BLINK FLUORESCENT STARTERS



The blinking of a failing fluorescent lamp not only annoys workers and lowers efficiency, but each blink costs actual money. It shortens the life of starters and ballasts—they burn out before they should. Here's how General Electric's Watch Dog* no-blink starters eliminate these needless costs.

- Watch Dog starters *stop blinking* by automatically turning off failing lamps that cause blinking.

- A Watch Dog starter *keeps the lamp off*—no recurring blinking every time fixtures are turned on.

- Because they eliminate blinking, Watch Dog starters *outlast* ordinary starters by as much as 10 to 1—ballasts also last longer.



Remember, too, emergency relamping is eliminated when you standardize on Watch Dog starters. And Watch Dog starters are essential to any schedule of group lamp replacement—the modern, economical method of lamp maintenance.

Specify Watch Dog no-blink starters for new fixtures—insist on them for replacement. You'll make important savings in maintenance costs and won't be bothered by blinking lamps. For all the facts on the Watch Dog starter line, write for a copy of folder Q46-418. Construction Materials Division, General Electric Company, Bridgeport 2, Conn.

*Registered Trade-mark General Electric Company

For all replacement needs—use the famous Watch Dog no-blink starter with the red reset button.

And here is the tag to look for when you buy fluorescent fixtures. It is an indication that the fixture has been equipped with G-E Watch Dog no-blink starters.





You can put your confidence in—

GENERAL ELECTRIC

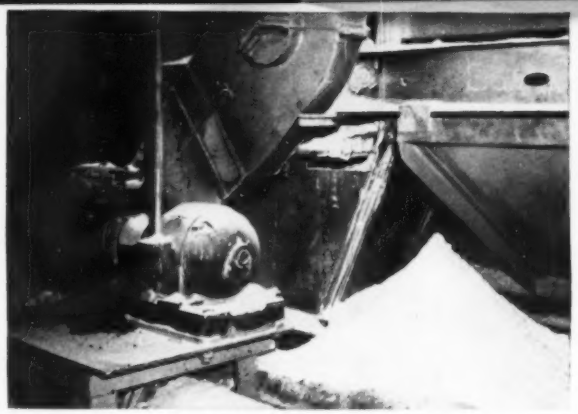


HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

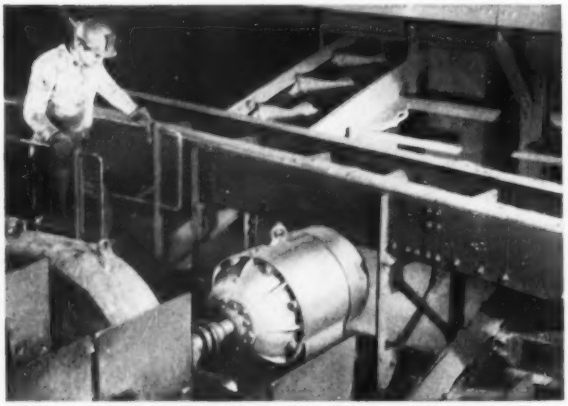
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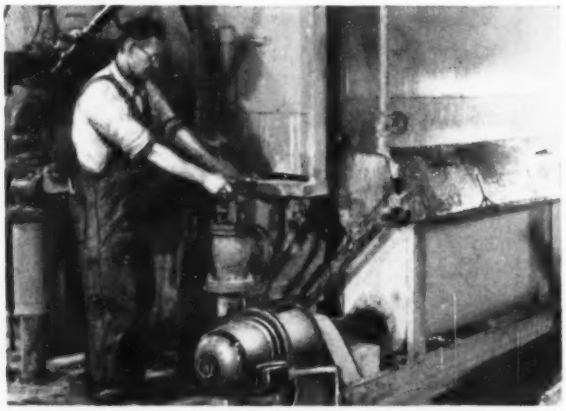
Abrasive metallic dust doesn't affect these six 7½-hp totally enclosed Tri-Clad* motors powering a metal polishing machine.



Laden with dust, this 3-hp totally enclosed non-ventilated Tri-Clad motor continues to stay on the job driving a soda ash conveyor.



Completely protected totally enclosed, fan-cooled, Tri-Clad motor has given long, continuous service without failure on this coal conveyor.



"Continuous Process" operation made possible in this beet-sugar refinery with totally enclosed Tri-Clad gear-motor driving a repulper.



Totally enclosed fan-cooled



Totally enclosed non-ventilated

G-E Motors and Control Give

G-E TRI-CLAD TOTALLY ENCLOSED MOTORS ARE BUILT TO MEET YOUR TOUGHEST REQUIREMENTS

For applications where your machines must operate in corrosive atmospheres containing dirt, oil, or metallic dust, General Electric *standard* Tri-Clad totally enclosed induction motors have all the needed protection—built right in. That's been proved on thousands of the toughest applications throughout all industry.

These motors, housed in corrosion-resistant cast-iron frames and endshields have all the well-known Tri-Clad protective features. Frames and endshields on every motor are designed to withstand heavy blows and are well protected from accidental damage while handling, mounting, or shipping, or from falling objects. Channel and rib sections give extra strength where needed without increasing the weight. In addition, provision has been made for re-lubrication should it ever become necessary.

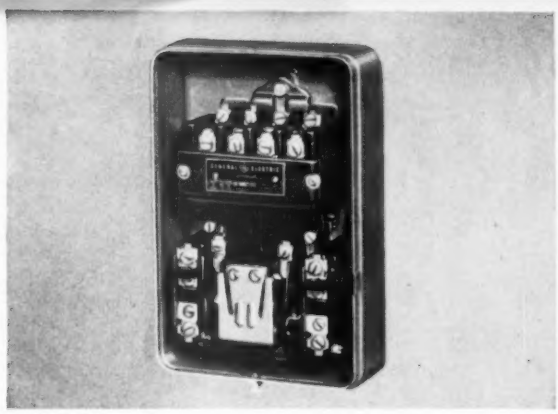
Totally enclosed fan-cooled or totally enclosed non-ventilated—both are standard "off-the-shelf" motors. That means ordering is simpler and shipment is faster. TENV motors are available in ratings from 1 to 5 hp; TEFC motors from 5 to 1000 hp.

*Reg. Trade-mark of General Electric Co.



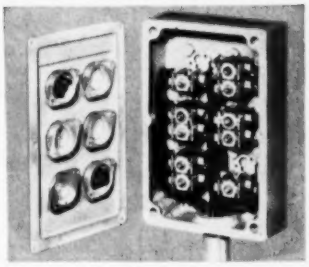
HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by GRAYBAR ELECTRIC COMPANY

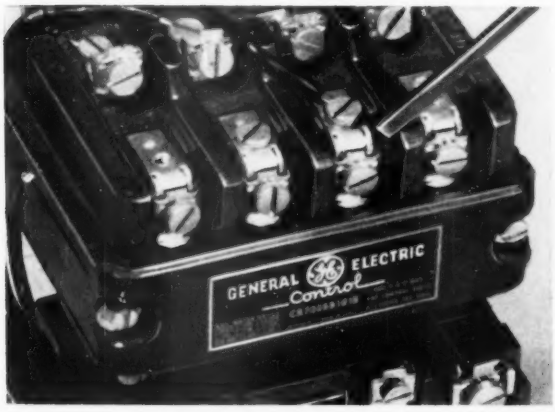


Production protection is afforded by reliable General Electric AC Motor Starters—built for longer life and easier wiring and maintenance.

NEW PUSH-BUTTON ENCLOSURES PERMIT BACK-MOUNTING UNITS, SPEED WIRING



In General Electric's complete new oiltight push-button line, one of the many new features is an improved enclosure design (taking 1 to 9 units) that lets you back-mount units to simplify wiring. Contact blocks stay in place when cover is removed, permitting fast, easy connections directly to the blocks. Saves wire, too. Units can be front-mounted as well. Stations with any combination of a wide variety of units are available.



Accessible terminals make electrical connections fast, easy. Panhead screws and saddle-type connectors assure easier connections.

BUILT TO MEET JIC STANDARDS: EXTRA-PROTECTED MAGNETIC STARTERS



For use in dust- and oil-laden atmospheres, these G-E combination starters for JIC standards offer such protective features as oil-resistant door gasket, dual-voltage transformer, and exterior mounting bracket. Reversing and non-reversing types are available in sizes from 1 to 5 for 220-, 440-, and 550-volt a-c motors up to 100 hp.

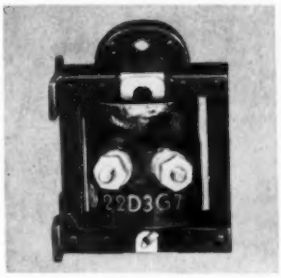
Longer Service, Need Less Upkeep

G-E AC MOTOR STARTERS BUILT FOR EXTRA LONG LIFE

Here are just a few of many features of General Electric motor starters that make them long-lasting. Fine silver contact tips plus extra-heavy contact construction spell long life. Arcs are snuffed at once by arc-resistant hood, prolonging contact life even more. Exclusive "Strongbox" magnet coil is locked in moisture-resistant plastic block to insure long coil life. These G-E starters are available in NEMA sizes 0, 1, 2, 3 for a-c motors up to 50 hp in general-purpose dust-tight, watertight, or explosion-proof enclosure

674-156

POSITIVE ACTION WITHOUT BOUNCE: HEAVY-DUTY AC OR DC SOLENOIDS



You get longer life from G-E heavy-duty a-c or d-c solenoids because laminated frame and plunger of high-grade steel are pressure-riveted. Carefully designed coils minimize possibility of grounding. Complete line includes ratings from ¾-in. stroke at 0.65-lb. thrust to 3-in. at 97-lb.

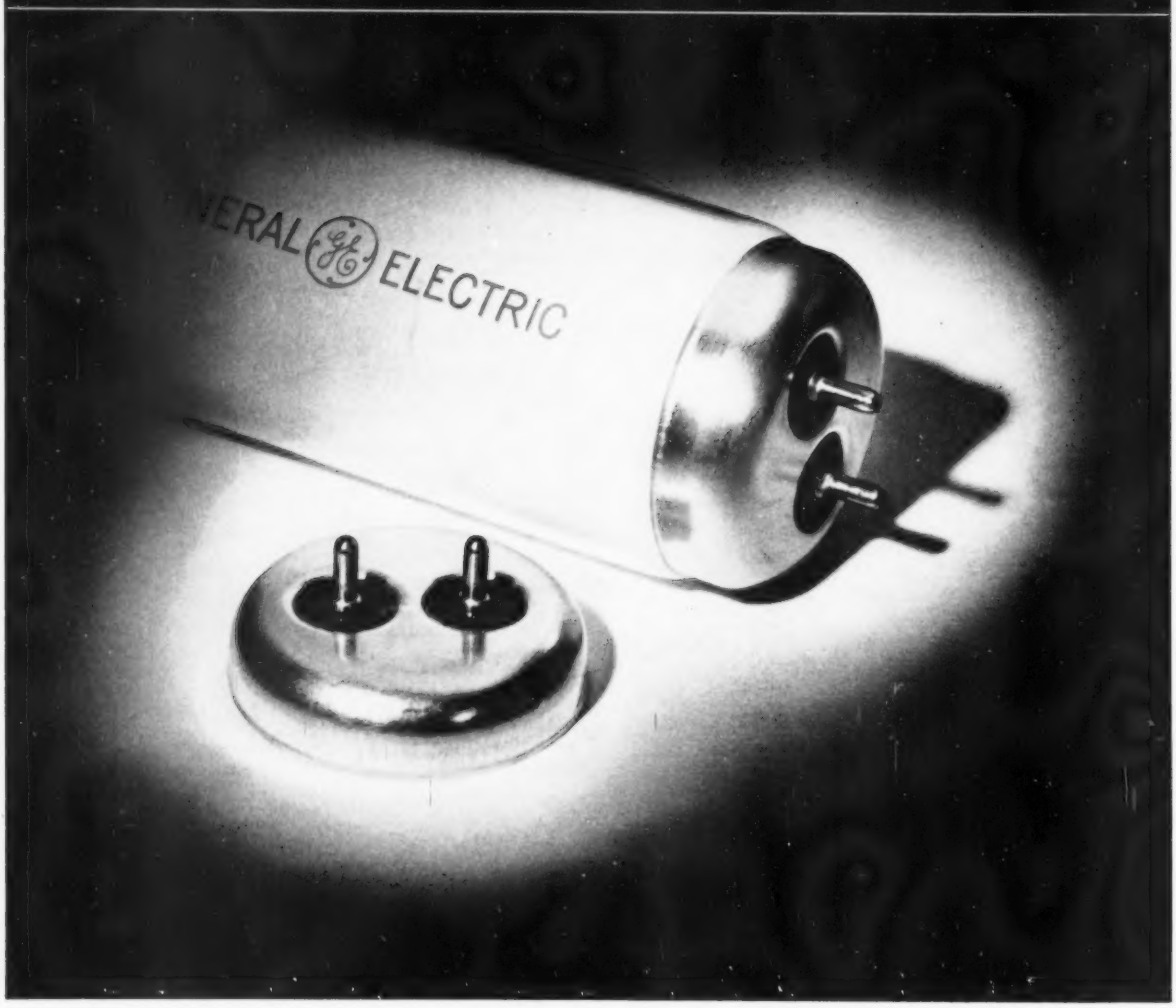
GENERAL ELECTRIC



HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by Graybar

You expect the best value from G-E fluorescent lamps



Rugged aluminum base helps G-E lamps last longer

You've probably noticed that G-E fluorescent lamps now have bases made of a white shiny metal, instead of the usual yellow brass or black plastic. It's aluminum.

Aluminum is light and resilient. Won't crack from hard bumps and jolts. Can take the high heats needed to get the best seal between base and glass tube. Doesn't shrink at low temperatures, won't crack the glass tube in cold weather. It helps prevent failure in G-E lamps.

Five years of General Electric lamp research helped make this use of aluminum possible. It shows again why you and your customers can *expect* the best value from G-E fluorescent lamps.

You can put your confidence in—

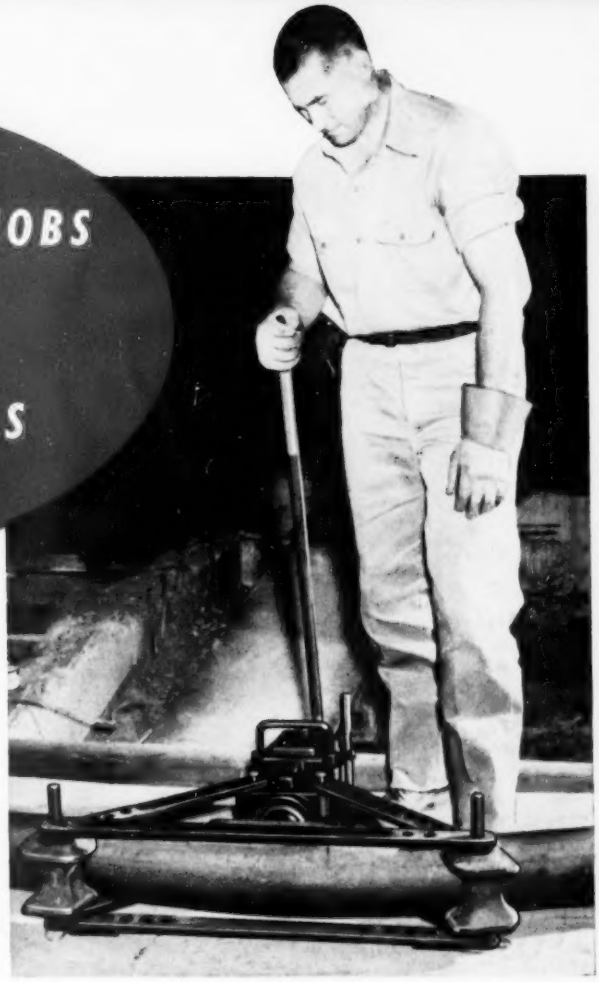
GENERAL ELECTRIC



HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by GRAYBAR

CUT COSTS...SPEED JOBS WITH GREENLEE TIMESAVING TOOLS



Greenlee Hydraulic Conduit Bender

Conduit installations go far faster . . . neat, tailor-made jobs result every time with a GREENLEE Bender. Many owners report labor savings from 50% to 90% . . . and the cost of many manufactured bends and fittings is eliminated. For, with the GREENLEE, *one man* in but minutes makes smooth, accurate bends in pipe up to 5", rigid and thin-wall conduit, tubing and bus bars. Compact and portable, the GREENLEE Hydraulic Bender can be easily and quickly moved for *on-the-job bending* exactly where and when wanted! *Users say it often pays for itself on the very first job.*



Hand Benders for Tubing

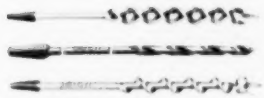
Swiftly produce accurate small-radius bends (up to 180°) in conduit, pipe and tubing. No flattening or kinks. GREENLEE Hand Benders are especially designed to form neat bends to fit sharp corners, nooks and other close quarters. Eliminates need for many manufactured bends and fittings. Various sizes and models . . . handy companion tools to GREENLEE Hydraulic Benders for quickly "custom making" your own complete conduit installations *right on the job.*



Knockout Punches and Hydraulic Punch Driver

Quick, easy way to make knockout enlargements for ½" to 4" conduit. Simply insert GREENLEE Knockout Punch in knockout or small drilled hole, then turn with an ordinary wrench. For an even faster, practically effortless operation, drive Punch with powerful, portable GREENLEE Hydraulic Driver shown below.





Boring Tools For quickly making clean, smooth openings for conduit and wiring. The GREENLEE line includes Electricians' Unispur and Solid-Center Auger Bits, Bell Hangers' Drills, Expansive Bits, and Bit Extensions.



Cable Puller Easy-operating, compact unit for 7,500 pound pull. Fastens directly to conduit for pulling in line with conduit . . . no loosened hangers. Attachment available for concealed conduit work.

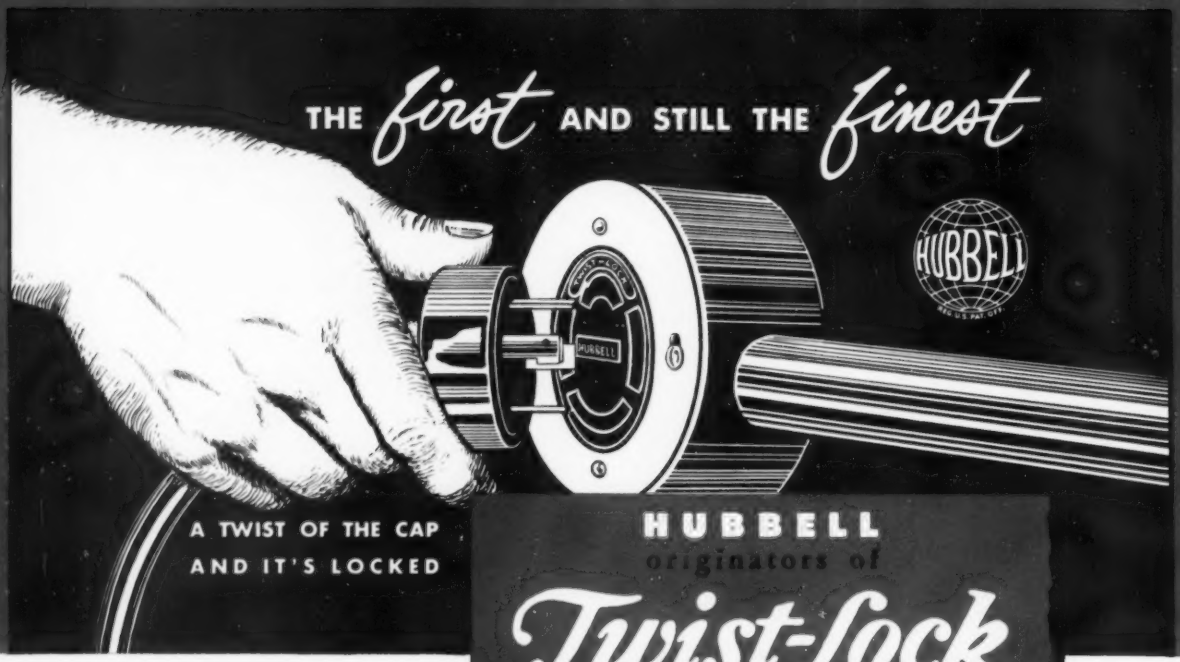
SEE YOUR ELECTRICAL DISTRIBUTOR Get complete information on the above and other GREENLEE timesaving tools: Hydraulic Pipe Pushers • Joist Borers • Chisels and Gouges • Radio Chassis Punches • Angle-Screw Drivers • Spiral Screw Drivers • Automatic Push Drills • and many more. Greenlee Tool Co., 1744 Columbia Avenue, Rockford, Illinois.

TOOLS FOR CRAFTSMEN
GREENLEE

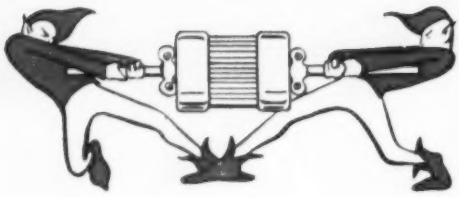


HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by Graybar



HUBBELL
originators of
Twist-Lock
(REG. U.S. PAT. OFF.)
CAPS AND RECEPTACLES



They Never Disconnect Accidentally!

Twist-Lock Wiring Devices are particularly desirable wherever portable, motor-driven tools and electrical apparatus are used. Twist-Lock devices eliminate time losses and annoying delays because they "stay-put" — are vibration proof — assure a lock-fast electrical connection under the most trying conditions — and give protection from shock and fire, through the use of properly polarized and grounded devices.

The unique locking principle that enables genuine Twist-Lock Devices to maintain uninterrupted electrical contact, regardless of tension or vibration, is an original Harvey Hubbell design and development. This locking principle has been an exclusive feature of the Hubbell line of electrical wiring devices for more than 23 years. In that time, Twist-Lock Devices have been so simplified and improved by Hubbell engineers that they have never been equalled.

Harvey Hubbell, Inc. has originated and pioneered many of today's standards in quality wiring devices. There have been imitators, but none can compare with Hubbell for experience, skill and craftsmanship.

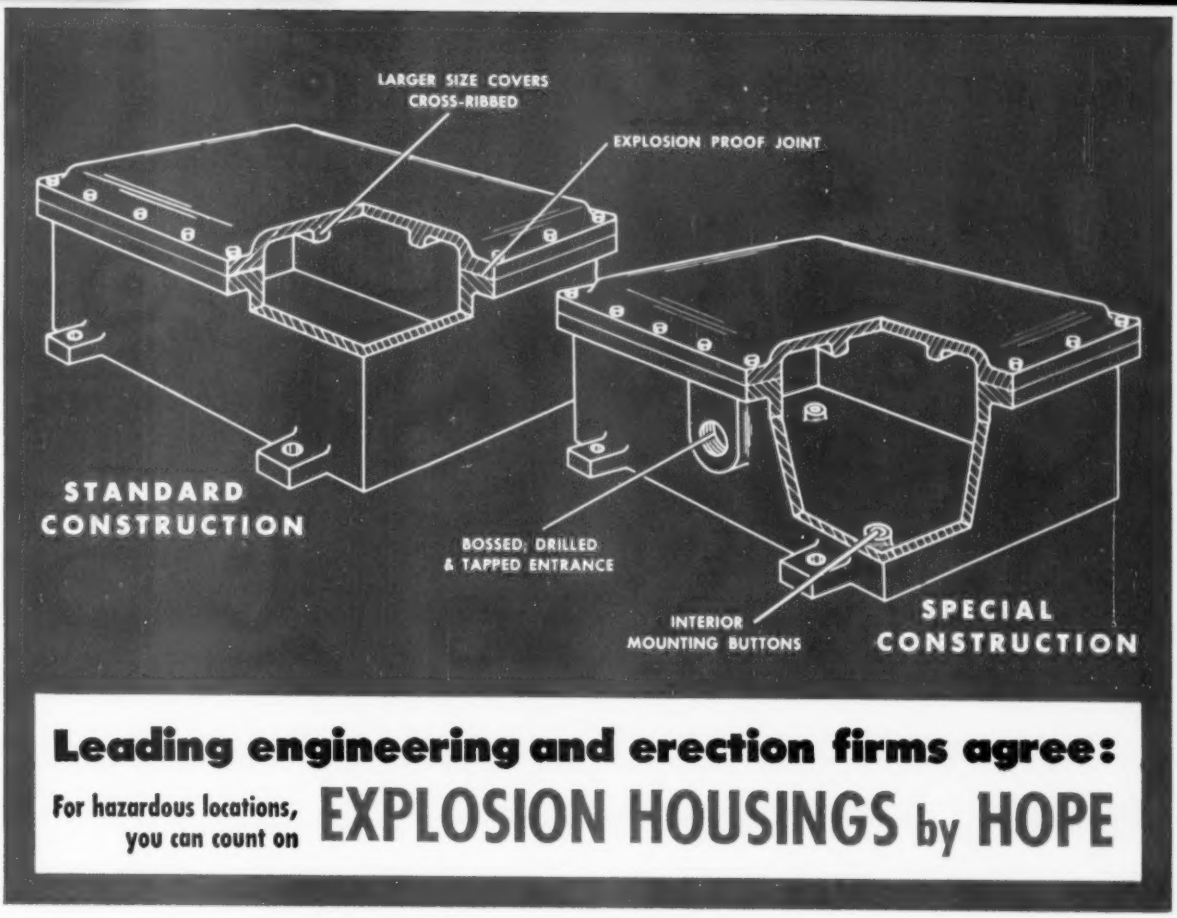
Manufacturers of Quality Wiring Devices for Over 60 Years

HARVEY HUBBELL, INC. HUBBELL **BRIDGEPORT, CONN.**



HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

GRAYBAR Distributed by GRAYBAR ELECTRIC COMPANY



Leading engineering and erection firms agree:

For hazardous locations, you can count on EXPLOSION HOUSINGS by HOPE

FIRST, see how *thoroughly* Explosion Housings by Hope meet every requirement for installation in Class I, Groups C and D hazardous locations.

Boxes and covers are of extra-strong construction. Covers are cross-ribbed on larger boxes. (Naturally, like all Boxes by Hope, Explosion Housings are of strong, dense cast iron, hot dip galvanized for both service durability and lastingly attractive appearance.)

Precision finished metal-to-metal joints assure explosion-proof construction. Housings have been successfully used as junction and pull boxes and as enclosures in refineries, chemical plants, paint plants, dry cleaning establishments, powder mills and pumping stations.

NEXT, see how *easily* Explosion Housings by Hope meet your every need:

You can select the Housing you want from a list of *81* standard sizes.

You can order special modifications at moderate cost. For instance: entrances can be drilled and tapped to your specifications. Bosses can be supplied to insure five threads on larger-sized conduit holes. Interior blind-tapped mounting buttons can be furnished for safe and easy installation of apparatus or panels. Heavy covers can be provided with bronze hinges.

AND . . . you can order the Explosion Housings you want — standard or with special modifications — through your local electrical distributor!

HOPE

ELECTRICAL PRODUCTS CO., INC.
338 Wilson Ave., Newark 5, N. J., Mitchell 2-4426

FOR THE FULL STORY ON EXPLOSION HOUSINGS BY HOPE
—and also on our line of hundreds of sizes of weatherproof products: outlet boxes and fittings, junction and pull boxes, hinged cabinets and terminal boxes—write on your letterhead for a copy of our latest catalog



HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by GraybaR

"Tool-Up" for Easier Wiring Jobs —AT LOWER COST!



Always Safe!

IDEAL

Wire-Nut®

Patented, No. 1,933,555
THE SOLDERLESS, TAPELESS WIRE CONNECTORS

- Twists, Threads, Grips and Insulates—ALL AT ONCE!
- No Special Tools
- Only ONE Piece to Handle

The Easiest Way to Make Fully Approved PIGTAIL SPLICES

Just screw a "Wire-Nut" on the stripped ends of the wires and you have a pull-proof, shake-proof splice that's actually stronger than the wire itself. You can't make a safer, stronger or longer-lasting splice.

"Wire-Nuts" Are Now Better Than Ever!

NEW phenolic compound shells are stronger—have higher dielectric—NEW buttress threads hold wire insulation tighter in skirt . . . NEW knurling makes them still easier to apply . . . NEW automatic machine assembly and inspection insure 100% uniformity in size, quality and finish.

Millions More "Wire-Nuts" are Used and in Use than Any Other Connector



Spliced for Life!

Contractors sizes 74B and 76B are fully approved as pressure cable connectors for general use in all types of branch circuit wiring. For all common wire combinations.

IDEAL Set Screw CONNECTORS



- Extra Strong Shell
- Extra High Dielectric
- Extra Strong Skirt
- Solid Brass Sleeve and Set-Screw

For Super-Strong, Super-Safe Pigtail Splices That You Can Inspect at Any Time

Takes just a few seconds per splice—and all you need is a screw-driver. Approved for 600 volts as pressure cable connectors for general use. High safety margin assured by 8000 volt dielectric and air gap tests and 80-lb. pull-out test. Easy to unscrew and re-use. Perfect for use when circuit layouts are planned for possible future change. Just two sizes needed for all common wire combinations.

THE NEW SUPER SAFE IDEAL Voltage Tester

You Can't Buy a Safer Tester —to Save Your Life!

The Voltage Tester that's safety-engineered at every point—with new convenience features for easier testing.



DOUBLE PROTECTION a solenoid, calibrated indicator AND a neon test lamp, each independent . . . NO CHANCE OF FAILURE TO DETECT VOLTAGE.



Cut Fishing Time in Half!

IDEAL

FISH TAPE, REEL and PULLER

Gives BIG pull and sure, safe grip that makes it easy to handle even long conduit runs. Tape is always under control—in the reel or in the conduit. Easy to reel in or pay out. Five sizes, 50 to 200 feet.

Save Time and Eliminate Wire Waste

IDEAL **WIRE STRIPPERS**



"E-Z"

The rugged, all-steel tool for heavy-duty stripping. Can't crush stranded wire. Six sizes, for wire gauges 8 to 30, plus 300 ohm Twin TV wire.



Stripomaster

The light weight "automatic" stripper with unique single-squeeze action. Almost effortless to use because of easy action and narrow handle span. Five sizes for all wire gauges from 8 to 22.

Other IDEAL Work-Saving Tools

B-X Cable Cutters
Fuse Clip Clamps and Reducers
Fuse Pullers
"Wire-Lube" Wire Pulling Lubricant

IDEAL HAS WHAT YOU NEED FOR EVERY WIRING JOB!

IDEAL INDUSTRIES, Inc.

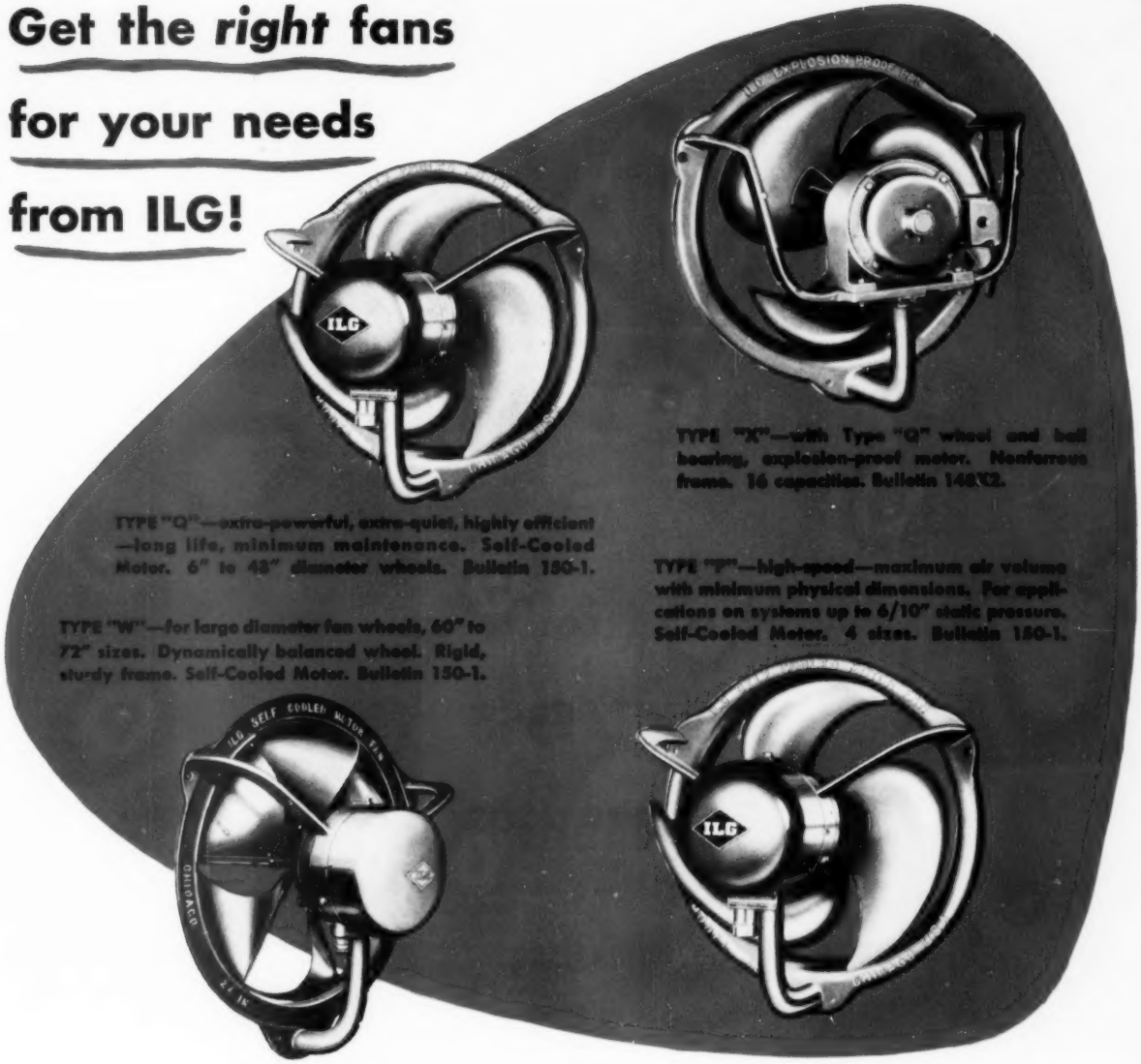
1041 Park Avenue, Sycamore, Illinois



HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by GRAYBAR

Get the *right* fans for your needs from ILG!



TYPE "Q"—extra-powerful, extra-quiet, highly efficient—long life, minimum maintenance. Self-Cooled Motor. 6" to 48" diameter wheels. Bulletin 150-1.

TYPE "X"—with Type "Q" wheel and ball bearing, explosion-proof motor. Nonferrous frame. 16 capacities. Bulletin 148-X2.

TYPE "W"—for large diameter fan wheels, 60" to 72" sizes. Dynamically balanced wheel. Rigid, sturdy frame. Self-Cooled Motor. Bulletin 150-1.

TYPE "P"—high-speed—maximum air volume with minimum physical dimensions. For applications on systems up to 6/10" static pressure. Self-Cooled Motor. 4 sizes. Bulletin 150-1.

All types, all sizes quickly available from nearby stocks!

ILG REG U S PAT OFF *knows ventilation!*

You can rely on ILG for the finest ventilating equipment money can buy. In principal cities, there are trained ventilating specialists ready to help solve your air-moving problems. Stocks of fans are maintained everywhere for quick service. Types for every requirement, ranging in sizes from a 6" diameter wheel (250 cfm capacity) to a 72" diameter wheel (40,500 cfm capacity) are readily available. Installation is a "cinch" in window, wall, or penthouse (with automatic shutter). Performance is beyond expectations—in whisper-quiet operation, economy of power, freedom from maintenance, and exceptionally long life.

An examination of an ILG product will prove why over 1,000,000 are now in use. The rugged frame expedites installation, keeps working parts in perfect alignment. Fan wheel is mounted directly onto motor shaft—no belts, no pulleys. The Self-Cooled Motor is specifically designed for exhaust fan duty—no foul air reaches it to interrupt service. Every ILG fan carries the NAFM label of Certified Ratings and the all-inclusive ILG "One-Name-Plate" Guarantee. Truly, it's the fan you can install with complete confidence. Get complete data now by phoning your nearby Branch Office, or writing . . .

ILG ELECTRIC VENTILATING CO.
2879 North Crawford Avenue, Chicago 41, Illinois
Offices in more than 50 Principal Cities



HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by Graybar Electric Company

JEFFERSON ELECTRIC

Jefferson Products

proved performance — proved satisfaction



BETTER BALLASTS FOR BETTER LIGHTING

Billions of hours of ballast operation by millions of Jefferson Ballasts have built their reputation for superb performance, economy, and trouble-free long life. The instant acceptance of U.L. Listed and E.T.L. Certified Jefferson Ballasts makes them the ideal line for you. All types of series sequence and lead-lag ballasts are available for every fluorescent or Slimline lamp installation, indoors or out. All are guaranteed for your protection. Stock up now!



JEFFERSON WIZARD BELL TRANSFORMER REPLACES 3 MODELS

Reduce door bell, buzzer, annunciator and door opener transformer stock by two-thirds—meet every requirement with a small, fast-moving stock of Jefferson universal mounting transformers!

Jefferson "Wizard" has a patented lip and set-screw to clamp transformer to outlet box, cover or cabinet. No mounting plates of any kind are needed. The foot bracket permits mounting for open wire installations anywhere. Primary leads and secondary terminals for bell wires are provided. 10 volt secondary—5 watts. *Listed by Underwriters' Laboratories, Inc.* Stock up now!



QUALITY FUSES FOR POSITIVE ELECTRICAL PROTECTION

Jefferson Saf-T-Lag thermal fuses enable you to fuse more closely to the load rating than any other type of fuse. Extra long time lag holds against motor starting loads and other temporary overloads to prevent needless shutdowns—yet Saf-T-Lags provide instant short circuit protection and thermal protection to motors, switches and panelboards.

A complete range of sizes of Saf-T-Lags, Super-Lags, Jefferson-Union Renewable, Gem Non-Renewable, Plug fuses and Jefferson Fustats are available to meet every requirement for maximum electrical protection. *Listed by Underwriters' Laboratories, Inc.* Stock up now!

JEFFERSON ELECTRIC COMPANY

BELLWOOD, ILLINOIS

In Canada: Canadian Jefferson Electric Co., Ltd., 384 Pape Ave., Toronto, Ont.



HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by Graybar

A BETTER FIXTURE FOR EVERY LIGHTING NEED... from Leader

Look to Leader for the finest in distinctive lighting for offices, commercial interiors, banks . . . proper styling and good looks in lighting for schools, libraries . . . flexibility and convenience in lighting for industry. Superbly efficient operation, unusual simplicity of installation and ease of servicing are outstanding features of the entire Leader line. Whatever your requirements may be, look to Leader for a better fixture to fill every lighting need.

Quality Fixtures for Quality Lighting



THE OFFICER

America's finest fluorescent fixture for interiors of distinction. Streamlined and gracefully proportioned. Translucent plastic side panels, one-piece injection moulded plastic louver with choice of 31° or 45° shielding. For two, three or four 40-watt lamps, or Slimline lamps in lengths from 48" to 96".

THE STRATOLINER



This heavy-duty, all-steel unit offers everything desired in an industrial fixture. Durable, strongly built, neat in appearance, easily serviced. Reflector finished in baked enamel or porcelain enamel (RLM approved). Available in open or closed end style for two or three 40-watt lamps, or two 85-watt lamps.

RECESSED TROFFERLITE



Leader troffer fixtures offer versatility of lighting design and high light values. Shown here with matching incandescent spotlight. Trofferlites are available with a wide variety of glass or specialized lenses, also in louvered, baffled and open styles. Complete range of lengths, choice of regular or shallow depth, 12" or 24" width, for from two to eight lamps.

Sold and installed by the better electrical dealers and contractors

Leader Division of Benjamin Electric Mfg. Co.

BENJAMIN ELECTRIC MFG. CO.
Des Plaines, Illinois



HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by Graybar



Treasury Department

Typical Private Office



Easy on the Eyes—

...with Lighting by LITECONTROL

Where illumination's concerned sales-minded electric utilities want the best. This one in Kentucky uses two types of standard LITECONTROL fixtures for efficient control of light . . . and smart appearance. Rolled-edge trim helps *hide* uneven spots in ceilings that flat trims only emphasize.

In the executive office, LITECONTROL No. 5134 with Holophane No. 9016 low brightness lens provides ample illumination—free from glare and sharp contrasts.

Easy to maintain. Lenses help keep dirt out. To clean—simply *push trigger-catch,* open door, wipe surfaces with damp rag, and *push door shut*—no tools required.

At left, LITECONTROL fixture No. 5838 is a practical selection for the general office. Rugged, all-metal design provides 35 to 25 degree cutoff from egg-crate louvers . . . holds glare down at critical viewing angles. No tools needed for servicing.

Two more examples of the "More Light and Looks for Your Money" you get with *every* LITECONTROL Fixture.

INSTALLATION: Kentucky Utilities Company, Lexington, Kentucky.
ARCHITECT: Robert W. McMeekin, Lexington, Kentucky.
LIGHTING ENGINEERS: R. W. Wilson, J. T. Cole & K. R. Cardey, Kentucky Utilities Company.
DISTRIBUTOR: Graybar Electric Company, Inc., Indianapolis, Indiana.
ELECTRICAL CONTRACTOR: Hatfield Electric Company, Indianapolis, Indiana.

Treasury Department

FIXTURES: 18 No. 5838, 3-lamp recessed louvered fixtures on 9' centers—standard cool white 96T12 lamps.
INTENSITY: Room average, 90 footcandles. Desk Tops 75-80 footcandles.

Typical Private Office

FIXTURES: 8 No. 5134, 3-lamp recessed fixtures with No. 9016 lenses on 8' centers—standard warm white 48T12 lamps.
INTENSITY: Room average, 70 footcandles. Desk Tops, 85 footcandles.

Note: Intensity figures by Kentucky Utility engineers after three months operation.

LC

LITECONTROL

Fixtures

LITECONTROL CORPORATION

36 PLEASANT STREET, WATERTOWN 72, MASSACHUSETTS

DESIGNERS, ENGINEERS AND MANUFACTURERS OF FLUORESCENT LIGHTING EQUIPMENT DISTRIBUTED ONLY THROUGH ACCREDITED WHOLESALERS



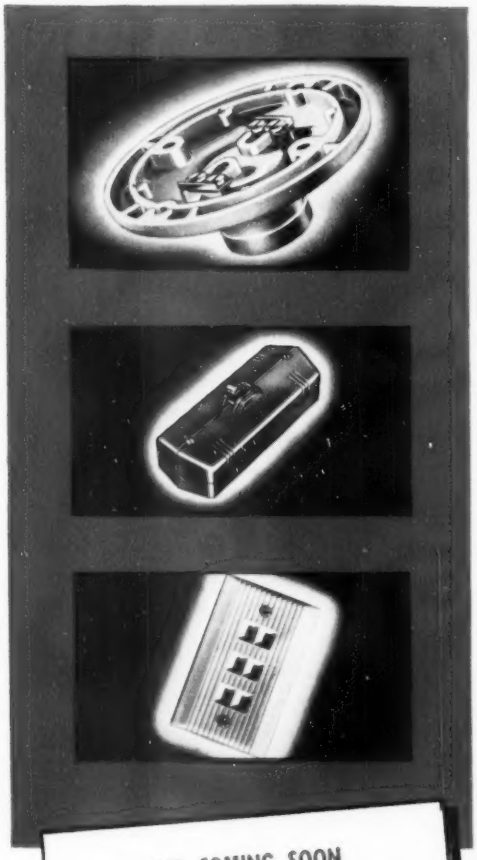
HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by GRAYBAR

If you're driving a 1925-model Service Truck

MONOWATT WIRING DEVICES are not for you!





AND COMING SOON
A GREAT BASIC IMPROVEMENT IN WIRING DEVICE TERMINATION.
WATCH FOR IT.

But if you want the advantages of modern design and materials . . . if you're interested in doing a better wiring job for your customers, and simplifying installation time on every job, then Monowatt Wiring Devices are definitely for you.

Here are the kind of extras you get with Monowatt Wiring Devices:

1. **EASIER INSTALLATION.** This keyless ceiling lampholder is a good example. One-piece, plastic construction eliminates assembling separate parts . . . reduces weight and is more resistant to chipping and cracking. Double splicing terminals eliminate soldering and taping for continuous wiring. You'll find similar advantages in other Monowatt Devices.

2. **SIMPLIFICATION.** Wherever possible Monowatt devices combine several traditional parts in one device. This eliminates the need for extra steps and cuts inventory requirements. Monowatt *Surf-A-Line* Wiring Devices, for example, incorporate five traditional parts in one unit.

3. **GREATER VALUE.** Monowatt devices offer your customers greater use, greater value. In this attractive combination plate and outlet, your customers get three outlets instead of the usual two.

4. **LOWER COST.** Take any Monowatt device and examine it feature for feature, part for part, with any similar device. You'll be surprised by Monowatt's superior quality — at competitive prices.

MONOWATT

DEPARTMENT OF GENERAL ELECTRIC COMPANY
PROVIDENCE 7, RHODE ISLAND



HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by GrayBar

MERCOID

AUTOMATIC CONTROLS

TEMPERATURE



—60°F. to 750°F.

PRESSURE



30" Vac. to 2500 P.S.I.

RELAYS



Single & Multiple Circuits

EXPLOSION-PROOF



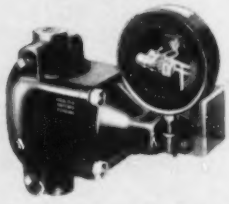
FOR EVERY TYPE OF APPLICATION

MERCURY SWITCHES



Tilting & Magnetic Types

LIQUID LEVEL

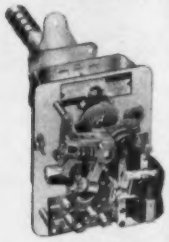


Pressures to 400 lbs.

WEATHER-PROOF



FOR OIL BURNERS



Constant or Intermittent Ignition

If you have a problem involving the automatic control of pressure, temperature, liquid level, mechanical operations, etc., it will pay you to consult Mercoid's engineering staff—always at your service.

For illustrated catalog describing the entire line of Mercoid Controls write for Catalog No. 700A



THE MERCOID CORPORATION

4209 BELMONT AVENUE · CHICAGO 41, ILLINOIS

New York: 205 E. 42nd St. · Philadelphia: 3137 N. Broad St.



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Distributed by Graybar

CONTRACTORS EVERYWHERE

DEPEND UPON THE CONSISTENT QUALITY OF

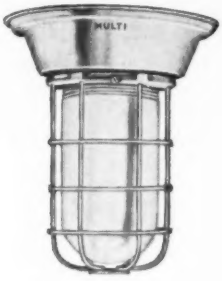
MULTI RLM
ELECTRICAL TESTING LABORATORIES, INC.

MULTI ELECTRIC MFG. INC.

4223-43 WEST LAKE STREET • CHICAGO 24

Lighting Equipment and Electrical Specialties

for QUALITY
SHOWER ROOM FIXTURES



for QUALITY with ECONOMY
MOISTUREPROOF FIXTURES



for QUALITY
GYMNASIUM FIXTURES



ALSO WITH
CAST ALUMINUM GUARD



for QUALITY
EXIT FIXTURES



for QUALITY
ILE-LITES



for QUALITY
PORCELAIN ENAMELED REFLECTORS



for QUALITY
CARTRIDGE FUSE CUTOUTS



SPECIAL ATTENTION GIVEN TO
PRODUCTION ACCOUNT REQUIREMENTS.

30 TO 600 AMPS
IN
250 VOLTS
600 VOLTS
MAIN LINE
AND BRANCH



SPECIAL BULLETIN
AVAILABLE UPON REQUEST

CHECK AND MAIL

☐ LIGHTING EQUIPMENT FOR
GYMNASIUMS & SWIMMING POOL

Name _____

Title _____

Firm _____

Address _____

City _____ Zone _____

State _____

ECM 4-53



HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA
GRAYBAR

Distributed by Graybar



"EVEREADY" NO. 1251 INDUSTRIAL FLASHLIGHT

Ruggedly built to yield a dividend of longer service life. Case is resistant to shock, water, oils, greases, gasoline, alcohol and acids. The heavy duty switch is easily removed and replaced by hand; ring hanger in bottom cap.



"EVEREADY" NO. 1050 INDUSTRIAL FLASHLIGHT BATTERY

Delivers *twice* the usable white light of any previous "Eveready" flashlight battery. Specially designed for repeated, heavy-duty use. Will not stick, swell or jam in your flashlight—has no metal can to leak or corrode.



"EVEREADY" NO. 1259 INDUSTRIAL FLASHLIGHT
(APPROVED SAFETY TYPE)

This popular model is approved by the U. S. Bureau of Mines for use in Methane and Air Mixtures and is listed by Underwriters' Laboratories, Inc. for use in gas and air mixtures of Class 1, Groups C and D. Ring hanger and spare bulb in bottom cap.

"EVEREADY" NO. 409 LANTERN BATTERY

For years the standard of dependability and long life in every kind of service. Designed to fit many popular types of hand lanterns. Use it wherever brilliant white light is a must.



For LONG LIFE, LOW OPERATING COST, DEPENDABILITY

specify these

EVEREADY
TRADE-MARK

products:



"EVEREADY" "IGNITOR" DRY CELL NO. 6

High quality and outstanding recuperative power make this battery the finest obtainable for such general applications as ignition, radio, bells, buzzers, electric games, toys, lanterns and other battery-operated devices.

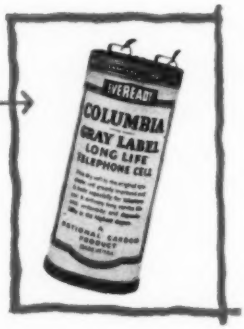


"EVEREADY" RR AND INDUSTRIAL DRY CELL NO. 6

Specially designed to meet a wide range of service conditions, from very heavy to very light drains.

"EVEREADY" "COLUMBIA" "GRAY LABEL" TELEPHONE CELL NO. 6

Extraordinarily long life...the most widely used telephone dry cell in the world!



The terms "Eveready", "Ignitor", "Columbia", "Gray Label", "Nine Lives" and the Cat Symbol are registered trade-marks of Union Carbide and Carbon Corporation

NATIONAL CARBON COMPANY

A Division of Union Carbide and Carbon Corporation • 30 East 42nd Street, New York 17, N. Y.

District Sales Offices: **Atlanta, Chicago, Dallas, Kansas City, New York, Pittsburgh, San Francisco**

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HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by GRAYBAR

SPECIFY LIFE-TIME PROTECTION NATIONAL ELECTRIC SHERARDUCT

Rigid Steel Conduit



HERE'S WHY—

1 It's the Sherardizing process that *fortifies* Sherarduct against rust and corrosion. This process drives a pure zinc coating into the steel surface—alloys the coating to the steel wall.

2 Still further protection is provided by the baked-on Shera-Solution coating that *seals* the zinc—fortifies SHERARDUCT against acids and other corrosive elements.

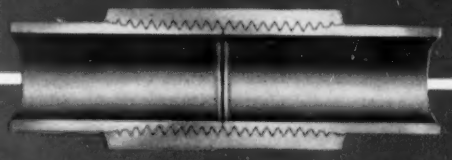
3 Even the base of the clean, sharp threads of Sherarduct Rigid Steel Conduit have full zinc protection. No need to worry about threads rusting even *before* you install it —not when you use *SHERARDUCT!*

THE SHERARDUCT COUPLING

. . . all surfaces and threads are zinc protected same as the conduit.

. . . accurately undercut threads permit completely closed joints . . . no raw threads exposed. No gaps to interfere with "easy fishing."

. . . further protected by baked-on Shera-Solution coating. Fully protected where danger of corrosion is greatest in conduit systems.



***The Result*—SHERARDUCT IS PERMANENTLY FORTIFIED FOR LIFE-TIME WIRING PROTECTION**

EVERYTHING IN WIRING POINTS TO

National Electric Products

PITTSBURGH, PA.

5 Plants · 7 Warehouses · 34 Sales Offices





HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

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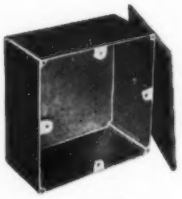
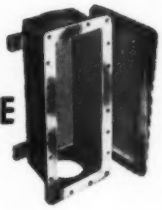


WE'VE HAD TO EXPAND!

And now we have not one  or two 

but three times  the capacity

to meet the demand  for

cast iron boxes like our types YS  and YE 

Everybody wants them 

for **O.Z.** boxes are quality controlled

from drawing board 

to completed box 

Of course, increased production

means revised 

Write  for your new price list today!



They're OK
if they're **O.Z.**

O.Z. ELECTRICAL MANUFACTURING COMPANY, INC.

262 BOND STREET · BROOKLYN 2, N. Y.

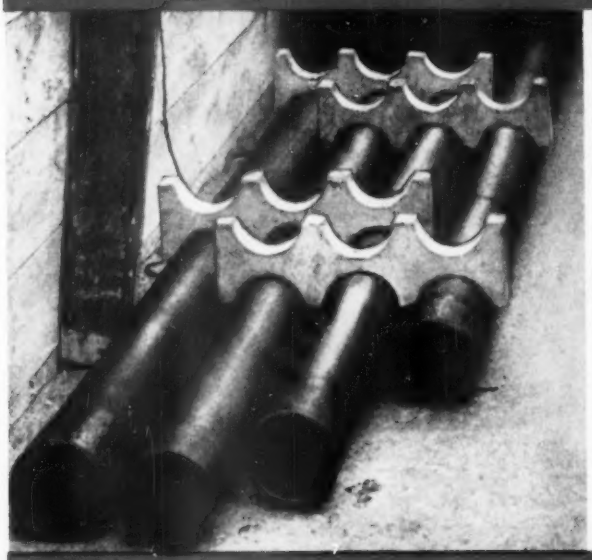
CONDUIT FITTINGS • CABLE TERMINATORS • CAST IRON BOXES
SOLDERLESS CONNECTORS • GROUNDING DEVICES • POWER CONNECTORS



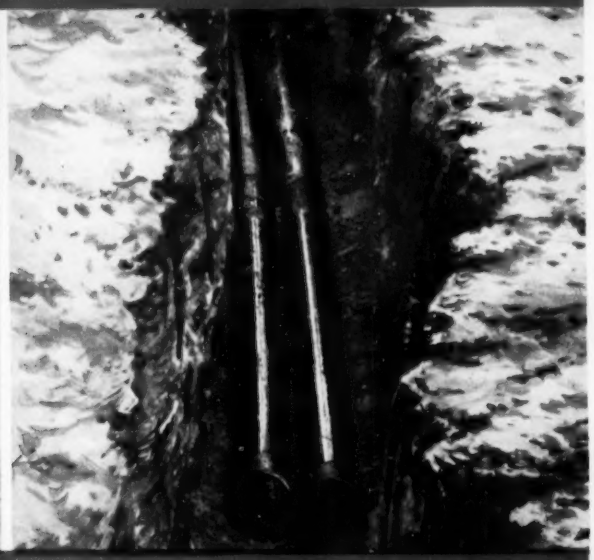
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Distributed by Graybar Electric Company

ORANGEBURG
FIBRE CONDUIT



STANDARD is installed with concrete encasement. Preferred for banks of three or more ducts.



NOCRETE is installed without concrete encasement. Extra heavy wall for direct burial—practical for use on single or double duct runs.

1893 ~ 60th Anniversary ~ 1953

COMPLETE CABLE PROTECTION AT MINIMUM COST

Orangeburg has had 60 years experience in the manufacture of non-metallic conduit serving the Power and Light, Telephone, General Construction, Railroad and other industries.

Orangeburg—the pioneer—has originated the outstanding advancements of the non-metallic conduit industry.

Orangeburg is a leader in every city and state.

ORANGEBURG QUALITY IS TIME TESTED

Orangeburg material is strong, tough and resilient. Lasts indefinitely. No cracks or breaks when properly installed. Impermeable walls, smooth bore. Low coefficient of friction. Resists acids, alkalies, salt and oil in ground waters. Water-tight joints. Light, easy to handle and tool. Lays faster and at lower cost than any other type of conduit.

Send to Dept. EC43 for facts. ORANGEBURG MANUFACTURING CO., INC., ORANGEBURG, N. Y.

ORANGEBURG
FIBRE CONDUIT

STANDARD INSTALLED WITH CONCRETE

NOCRETE INSTALLED WITHOUT CONCRETE

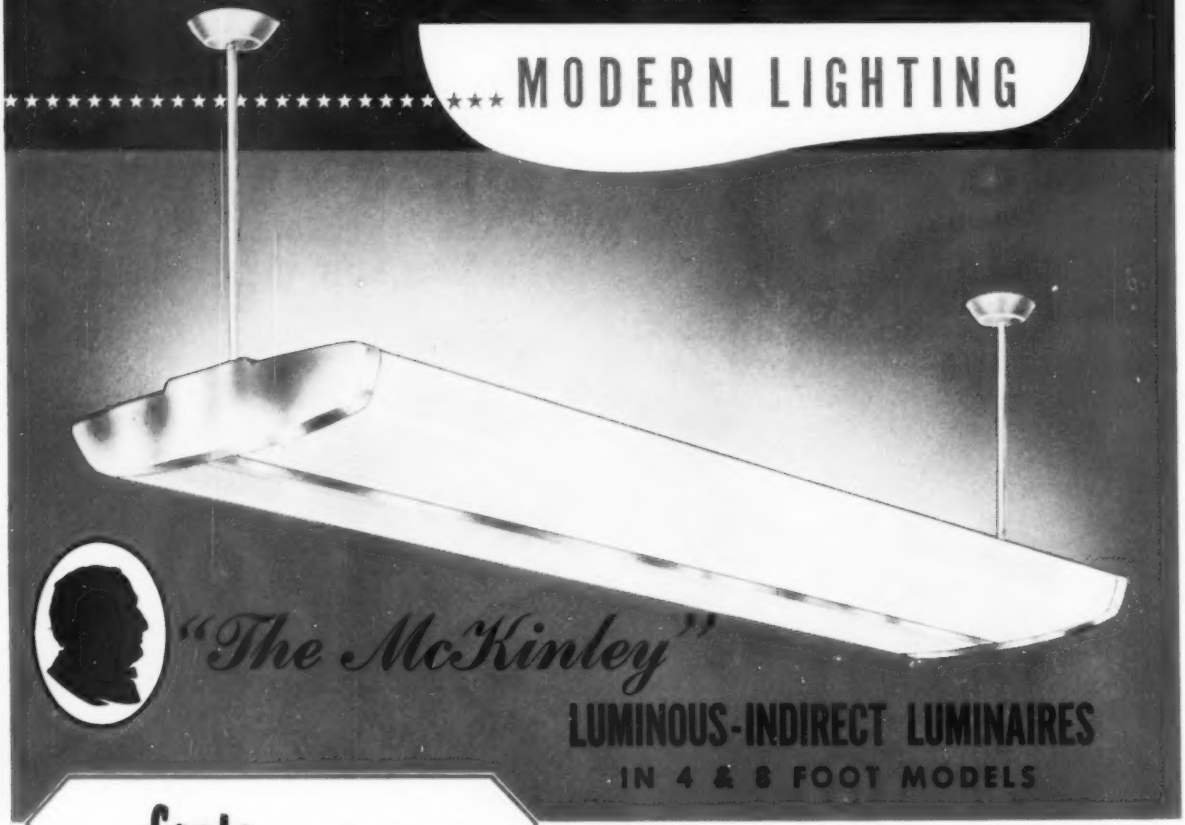


HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by GRAYBAR

setting NEW high standards in.....

MODERN LIGHTING



"The McKinley"

LUMINOUS-INDIRECT LUMINAIRES

IN 4 & 8 FOOT MODELS

facts ABOUT THE NEW A & B-9000 SERIES, 4 & 8 FOOT "McKINLEY" FLUORESCENT LUMINAIRES

- **THE McKINLEY** is available in 4 or 8 foot units using two lamp bi-pin fluorescent lamps. In slimline lamps, it is available in 4 and 8 foot, two and four lamp units.
- **THE McKINLEY** is pendant mounted individually or in continuous rows using time-saving Pittsburgh "H" series hangers.
- **THE McKINLEY** has a rugged chassis. 8-foot units need hangers only at the ends. On all units, hangers may be installed at any point along the raceway to avoid pipes, beams and other obstructions.



WRITE for DATA SHEET

Bulletin B-9 contains complete information and dimensions on the new "McKinley." Write for your copy today.

"Pittsburgh" Permaflector

"The McKinley"—newest addition to the famous Pittsburgh Presidential Series of Fluorescent Luminaires—is setting new high standards for *luminous-indirect* luminaires. Beautiful, modern styling plus high overall efficiencies make it truly a creative example of sound illuminating engineering.

The luminous panels of white, ribbed polystyrene give "The McKinley" high reflectivity with low surface brightness and produce a luxurious quality of illumination. When lighted, the luminaire blends into the ceiling since its brightness and that of the ceiling are almost equal.

"The McKinley" more than meets the brightness specification of the Illuminating Engineering Society, the American Institute of Architects and the American Standards Association.

PITTSBURGH

REFLECTOR COMPANY

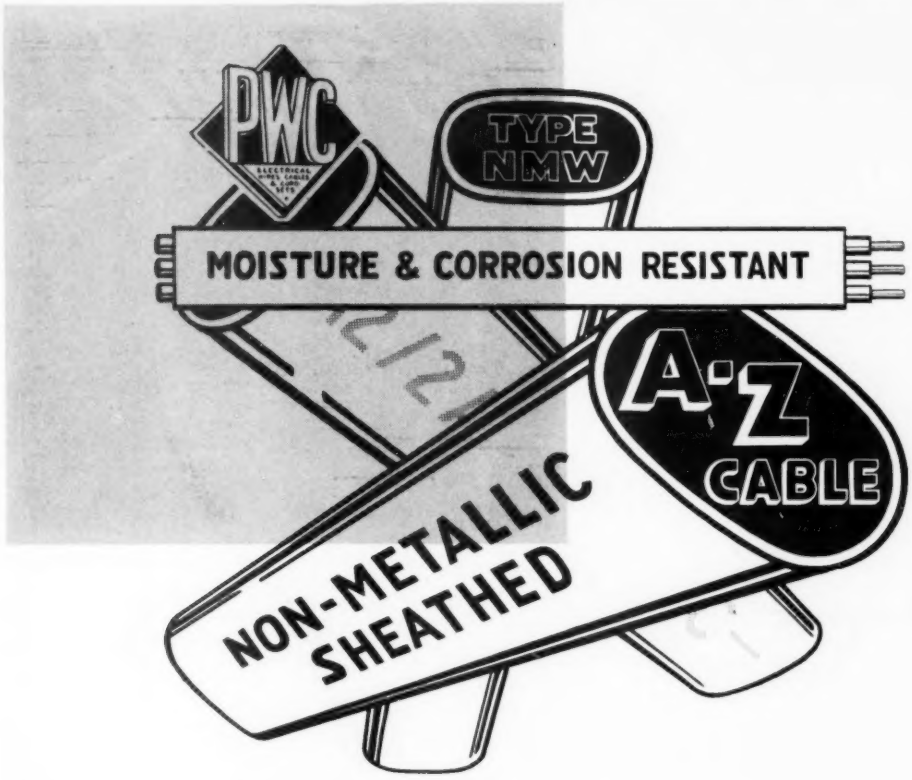
404 OLIVER BUILDING • PITTSBURGH 22, PENNSYLVANIA

Manufacturers of Fluorescent and Incandescent Lighting Equipment



HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by Graybar

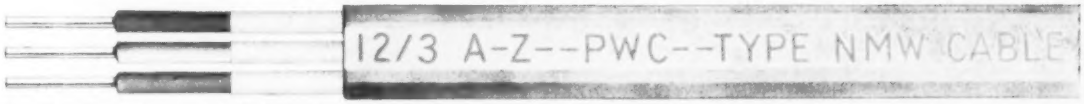




Each conductor is insulated with the specially developed wide-temperature-range TW grade compound and then encased with a glass fiber serving. The integral web and sheath is also of the same special moisture-resistant insulating-grade compound thus providing additional electrical as well as mechanical protection. The Type NMW classification identification is provided in the surface marking on A-Z Cable.



Where a grounding conductor is required for fixtures and appliances in kitchens, bathrooms and the like an uninsulated conductor is provided in the web between the insulated conductors. A-Z Cables with this feature are specially identified in the surface marking as shown in the illustration above.



The three conductor "A-Z" Cable is made in the unique space-saving flat construction which can be readily formed into neat edgewise bends. The insulation on the three conductors is color-coded black, white and red. It features the same exceptional compounds as the two conductor cables.

Manufactured in AWG sizes #14, #12, #10

PLASTIC WIRE & CABLE CORPORATION
JEWETT CITY, CONN.



HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by GRAYBAR

Conquer the Dark—

REVERE 2000 SERIES LONG RANGE REAR SERVICE FLOODLIGHT

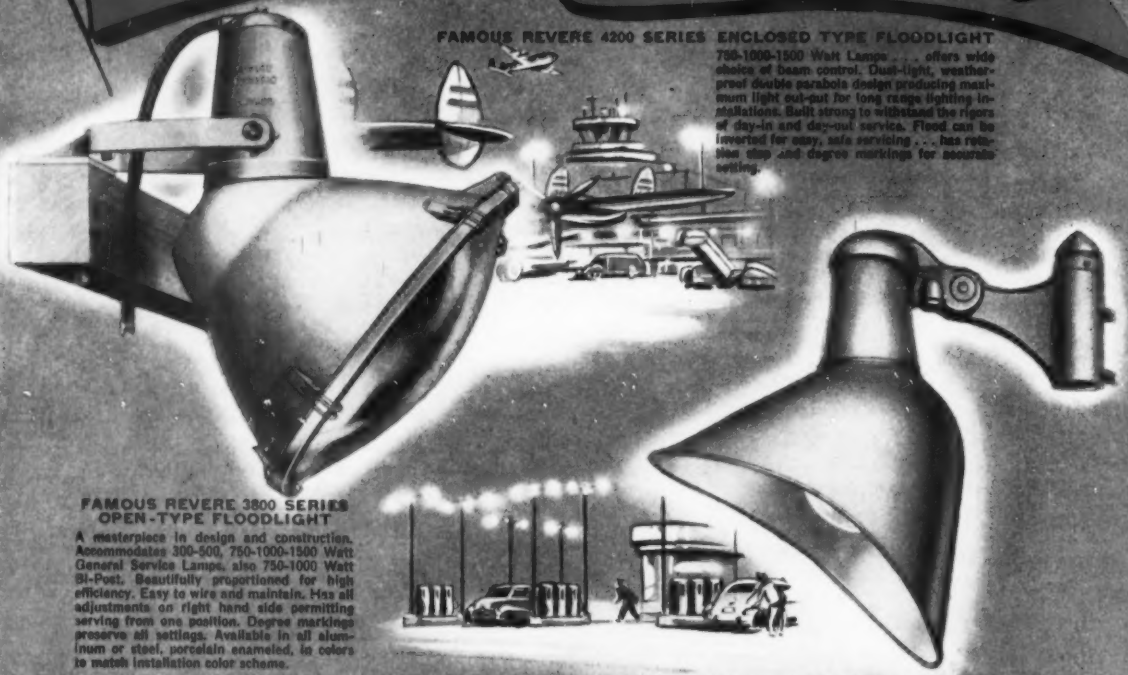
Utilizes 750-1000 or 1500 Watt Lamps. 18" and 20" lens sizes. Lens remains stationary when servicing—no breakage of glass—no loose parts to dangle in the wind or drop to the ground . . . weather-tight . . . all parts weather resistant. Finest Flood for sports lighting and similar installations where distance is a factor.



With Revere ELECTRIC MFG. CO. CHICAGO, U.S.A. FLOODLIGHTS

FAMOUS REVERE 4200 SERIES ENCLOSED TYPE FLOODLIGHT

750-1000-1500 Watt Lamps . . . offers wide choice of beam control. Dust-tight, weather-proof double parabola design producing maximum light out-put for long range lighting installations. Built strong to withstand the rigors of day-in and day-out service. Flood can be inverted for easy, safe servicing . . . has rotation stop and degree markings for accurate setting.



FAMOUS REVERE 3800 SERIES OPEN-TYPE FLOODLIGHT

A masterpiece in design and construction. Accommodates 300-500, 750-1000-1500 Watt General Service Lamps, also 750-1000 Watt Bi-Post. Beautifully proportioned for high efficiency. Easy to wire and maintain. Has all adjustments on right hand side permitting serving from one position. Degree markings preserve all settings. Available in all aluminum or steel, porcelain enameled, in colors to match installation color scheme.

The above Floodlights typify the entire Revere Line which comprises units from 75 to 5000 Watt capacity. Revere leadership in the field of Sports, Airport, Service-Station, Street, Industrial and Outdoor Theater Lighting Equipment is based upon reputation for superior design, workmanship and high efficiency. Electrical distributors who have made their comparisons are aware that their selling job is easier when the name Revere is mentioned. The quality can be depended upon and the line is broad—in a range of prices to meet all conditions. A Revere display stand for your show room will work wonders! Consult us today!

REVERE ELECTRIC MANUFACTURING CO.
6011 BROADWAY • CHICAGO 40, ILLINOIS

WE COVER THE FIELD WITH A COMPLETE LINE OF . . . SERVICE STATION • AIRPORT • SPORTS • STREET • OUTDOOR THEATRE • MARINE AND INDUSTRIAL LIGHTING EQUIPMENT



HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by GRAYBAR

WHAT DO YOU NEED IN A TIME SWITCH?

Short OFF Periods?

If your application needs a minimum OFF period as low as 30 minutes Sangamo can furnish a switch with reversed time limits, so that the minimum OFF period is considerably shorter than the minimum ON period.

Omitting Devices?

Your Sangamo time switch can omit one or more days of repetitive operation from a weekly schedule for applications where factories are closed on Sunday, on week-ends, or on any other days of the week.

Advance Time Control?

If you need an earlier than normal start on some special operation, Sangamo can furnish an auxiliary control to provide an early ON operation on any given day or days of the week.

Synchronous Carryover?

When equipped with the carryover, Sangamo Time Switches keep right on running—even when the electric power fails. An electrically wound main spring automatically takes over until power is restored. It provides up to 10 hours of reserve operation.

Sun Time Operation?

The famous Sangamo Astronomic Dial functions automatically to control daily time switch operation in accordance with the time of sunset and sunrise, compensating daily for the changing seasons. No periodic manual resetting is required.

Sangamo has the answer..!

If you need time switches for the simplest single ON and OFF operation, or for complex weekly schedules, Sangamo can fit your exact needs from the complete line with special control features.

All Sangamo Heavy-Duty Time Switches are built to provide an *extra* margin of dependability, and all have these features:

LOW-SPEED MOTOR

The exclusive Sangamo built low-speed low loss motor (450 R.P.M.) means less bearing wear, and, consequently more years of service.

LIFETIME LUBRICATION

A special silicone grease assures perfect operation in a temperature range from 50 degree F. below zero to 200 degree F. above. No special motor coils are required even in the coldest climates.

OVERSIZE SILVER CONTACTS

The pure silver contacts are very conservatively rated and minimize troublesome arcing by combining a slow break action with a small gap.

MACHINE-CUT GEARS

The heavy gears are precision made. They transmit the power to the dial smoothly and possess strength in excess of any service requirements.



SANGAMO
ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

SANGAMO

Get the full story . . . Write for Catalog No.

ST52-8



HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by GRAYBAR ELECTRIC COMPANY

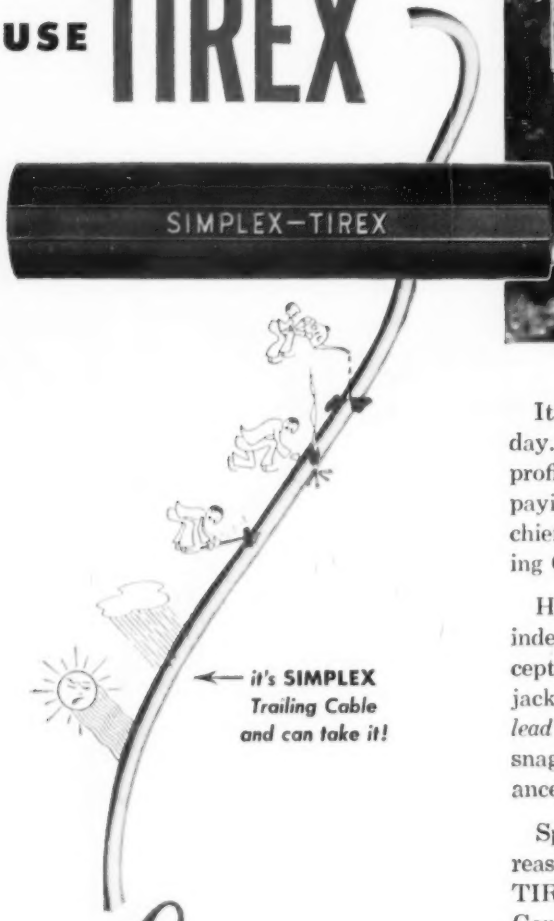
WHERE

Steady Power

COUNTS...

USE **TIREX**





It's dig and dump, dig and dump, all day, every working day. That's the kind of operation that reduces costs and builds profits. Stop this shovel for one day and you come close to paying the price of a new cable. The output of this shovel is chiefly determined by the performance of its TIREX Trailing Cable. And output must be high.

Here's why TIREX Trailing Cable will stay on the job indefinitely. It has a tough neoprene armor that provides exceptional resistance to wear and tear. The smooth, dense jacket of TIREX Trailing Cable is a product of the *cured-in-lead* process that provides excellent resistance to abrasion, snagging and crushing. TIREX Trailing Cable offers a balanced resistance to oils, grease, moisture, flame and sunlight.

Specify and get TIREX Trailing Cable for this important reason: It is always on the job — always ready to work. TIREX Trailing Cable is always marked for your protection. Contact your nearest Simplex representative or write for more complete information.

Simplex WIRES & CABLES

TIREX CORDS AND CABLES *are made only by the*

SIMPLEX WIRE & CABLE CO., 79 Sidney Street, Cambridge 39, Massachusetts



HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by Graybar

R&S Receptacles, Plugs and Switches



—first line of defense against weather, water and industrial hazards!

R&S receptacles, plugs, connectors and switches are available in an endless variety of weatherproof, waterproof and explosion-proof types, sizes and assembly combinations—the most complete line of fittings ever made to meet every industrial operating requirement.

Russell & Stoll quality adds maximum permanency and protection to your wiring plans. The finest in materials, rugged construction, precision manufacture and exclusive design features, combine to assure ease of installation, reliable operation, low maintenance and long service life.

Write for literature *concerning items in which you have a specific interest.*

RUSSELL & STOLL COMPANY, INC. • 125 BARCLAY STREET, NEW YORK 7, N.Y. D9

RUSSELL & STOLL

PRECISION-BUILT ELECTRICAL EQUIPMENT—SINCE 1902



HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by GraybaR

SPANG®

THE COMPLETE LINE OF TOP-FLIGHT CONDUIT . . .

AT YOUR SERVICE!

. . . for easier bending . . . for easier threading . . . for better installation . . . for more profits . . .

SPANG Conduit gives you these advantages because it is made of top-grade, quality-controlled steel, formed under exact heat conditions and inspected constantly during manufacture.

The care that goes into the manufacture and delivery of SPANG Conduit right up through the time it arrives at your distributor's makes SPANG a real quality-controlled product. When you ask for SPANG, you get a top-flight product . . . clean, workable, with years of dependable service built into it.

Ask any electrical contractor about SPANG Conduit—he'll tell you *why* SPANG is better!

CENLACO . . .

hot dipped and lacquered rigid steel conduit, easy to work and bend . . . exceptional corrosion-resisting properties. Couplings hot dipped zinc coated with electro-galvanized threads.



SPANG EMT . . .

lightweight steel tubing with the new SPANGLEAM electro-galvanized exterior finish for better appearance and the new interior coating of resinous lacquer compounded with Zirconium for easy wire pulling, assured grounding and corrosion resistance. Easy to cut, bend and install.



CENTRAL BLACK . . .

Black enamel rigid steel conduit, easy to work and bend . . . surfaces will not crack, chip or flake under the most severe bending strains. Couplings pickled before application.



CENTRAL WHITE . . .

Electro-galvanized rigid steel conduit, easy to work and bend . . . interior coating of black enamel assures a smooth surface, making an ideal raceway for easy wire pulling.



SPANG CONDUIT

SPANG-CHALFANT
Division of The National Supply Company
GENERAL SALES OFFICE:
PITTSBURGH 30, PA.
District Offices and Sales Representatives in Principal Cities



HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by GraybaR

SILVRAY

LIGHTING FIXTURES

FOR

COMMERCIAL
INDUSTRIAL
RESIDENTIAL
AND SCHOOL
APPLICATIONS

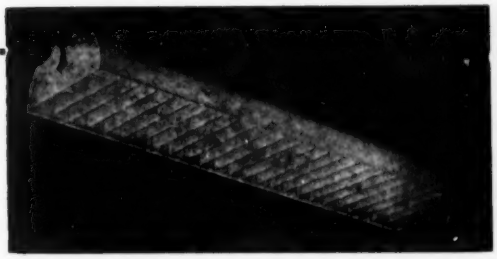


THE SUPER 1500 LINE

Concentric ring indirect luminaires designed to make the most efficient use of the silvered-bowl lamp. 90% of the generated light is uniformly distributed over the ceiling to provide highest quality overall lighting. Requires no cleaning because of vertical surfaces. Relamps from the floor. Used in schools, offices, libraries. Ceiling and pendant types.

THE 33 LINE

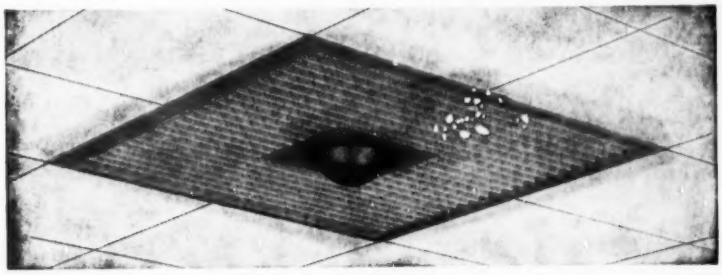
Provides an effective solution for a wide variety of lighting applications, and maximum flexibility to meet specific requirements. Interchangeable louvers provide either 35° x 35° or 40° x 40° shielding. Designed for 2 or 4 fluorescent or slimline lamps. Suspension or close ceiling mounted types for individual or continuous row mounting. Recommended for offices, banks, stores, schools.



SKYLIKE

A SILVRAY ASSOCIATED COMPANY

SKYLIKE: The modern, modular lighting unit designed for use with 150W-500W silvered bowl lamps. Has its own basic reflector, louver assembly and a group of accessories to adapt it to an extremely wide variety of applications and installation requirements. Can be used with silvered or semi-silvered bowl lamps for wide or concentrated light distribution. Easy to install, requires minimum maintenance as there is no place for dust to lodge and they relamp from the floor. Surface, semi-recessed, suspended, recessed types. Ideal for schools, stores, offices and residential applications.





SILVERSPOT: A new modern recessed downlight that provides efficient and precisely controlled direct illumination. Uses 100W-A-21 silvered bowl lamp which in conjunction with reflector and louver eliminates glare from the surface. Surface mounted, recessed and screw-in "adaptor" types. A perfect "spot" for stores and residential application.

SILVERDOT: Similar to above but with 6½" aperture instead of louver. Used to provide accent or special lighting effects in commercial or residential interiors.

Complete information on any of the above Silvray or Skylike units is available at your nearest Graybar district office. There is a descriptive booklet for each unit which will be supplied on request. Contact Graybar or write us direct.

SILVRAY LIGHTING, INC.

AND ASSOCIATED COMPANIES

RKO BUILDING • RADIO CITY • NEW YORK 20



HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by Graybar

CLEANEST and EASIEST

TROFFER INSTALLATION I EVER MADE says:

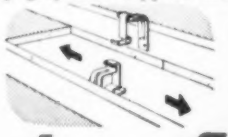
Mr. Frank Coughlin
J. Livingston and Company
Boston, Massachusetts

"You normally expect headaches with a recessed troffer installation, but the Smithcraft Troffer installation in the New Hampshire Fire Insurance Co. in Manchester, N. H. was fast, clean and easy. And the finished appearance was something we could really be proud of! Undoubtedly, the Smithcraft Aligner Hanger had a lot to do with it. It eliminated the need for careful dimensioning and locating of hangers and we could level the troffers easily even after the wiring was completed and the ceiling in place."

●

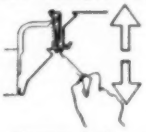
That's the way it is with Smithcraft Troffer installations! Smithcraft Troffers can be installed in a fraction of the usual time required. They can be installed in any type ceiling construction . . . *and installed right!* Smithcraft Aligner Hangers (Patent No. 2,597,875), four or six to a frame, are mounted almost haphazardly without critical measuring. They grip and support the housing securely. After the wiring is completed, the reflector







is installed and the troffer is then levelled with the ceiling by simple screwdriver adjustment of the Aligner Hanger. The cover plate is inserted and the shielding medium is swung into place.



Smithcraft Troffers are available with a wide variety of shielding components for one, two or three 40-watt Bi-Pin (Regular or Rapid-Start) or 48", 72" and 96" Slimline Lamps. For appearance, ease of installation, simplicity of maintenance and lighting performance, the Smithcraft Troffer is in a class by itself.

Shown below are views of the Smithcraft Troffer installation in the offices of the New Hampshire Fire Insurance Company, Manchester, New Hampshire. *Architect:* CRAM AND FERGUSON, BOSTON, *Electrical Engineers:* THOMPSON ENGINEERING COMPANY, BOSTON, *Electrical Contractors:* J. LIVINGSTON & COMPANY, BOSTON.





Smithcraft

LIGHTING DIVISION, CHELSEA 50, MASS.



HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by Graybar

FARADAY®

the Emblem of Quality since 1875

Electrical Signals and Systems



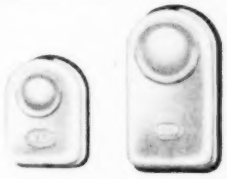
UNIPACT SIGNALS. Need one—or a series of bells, chimes, buzzers or horns? You can have your choice, because these various types of signals are interchangeable; no new wiring is needed. UNI-PACT Signals meet noise level requirements with tailor-made results.



FARADAY FIRE SYSTEMS. FARADAY Fire Alarms provide *extra* protection. A wide variety of systems to meet all fire warning requirements. Models available for surface or semi-flush installations. FARADAY is known for dependability throughout the industry.



FARADAY CLOCKS. Can be furnished for remote control by master units, or for direct-operating installations. FARADAY models are supplied for either surface or flush mounting, in 10, 12, 15 and 18 inch sizes. Easy-to read dials are white, with bold Arabic numerals.



FARADAY BELLS AND BUZZERS. A complete selection of both bells and buzzers for homes, offices, hotels and apartment buildings. Attractive appearance . . . long-lasting. Years of research and production experience make FARADAY signals the outstanding brand—always dependable.

CONSULT YOUR ELECTRICAL WHOLESALER FOR COMPLETE DETAILS.

HOLTZER-CABOT **FARADAY** STANLEY & PATTERSON

CONSOLIDATED BY:

SPERTI FARADAY INC.

ADRIAN, MICH.

BELLS • BUZZERS • HORNS • CHIMES • VISUAL AND AUDIBLE PAGING DEVICES AND SYSTEMS



HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by GRAYBAR



Any way you look at it...

SQUARE D's balanced* design means a better Motor Starter

*Designed to provide the highest degree of accessibility, flexibility, and compactness —with no sacrifice of performance and long life.

EASY WIRING...

Plenty of wiring space and easy-to-get-at solderless terminals. Installation is a breeze.

ACCESSIBILITY...

Coils, contacts or overload relays can be changed without disturbing external connections. A screwdriver is the only tool you need.

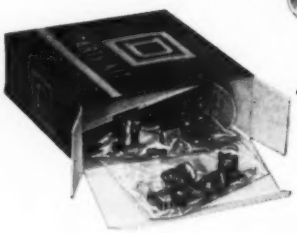
FLEXIBILITY...

Three extra electrical interlocks may be added to size 1 starters; four to sizes 2 and 3. Contacts may be normally open, normally closed, or double circuit.

PERFORMANCE...

Straight line, guided motion minimizes wear. Large silver alloy contacts insure exceptionally long life and trouble-free performance.





"Off-the-Shelf" Parts Kits make normal maintenance easier than ever. Each kit contains parts necessary to replace all load contacts and finger springs. Electrical interlocks also available in kit form.

MOTOR STARTERS and other Square D Products are distributed by GRAYBAR

SQUARE D COMPANY

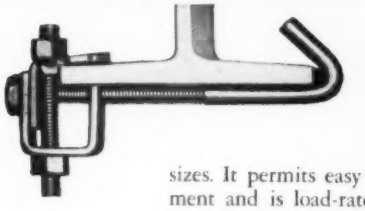


HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by Graybar Electric Company

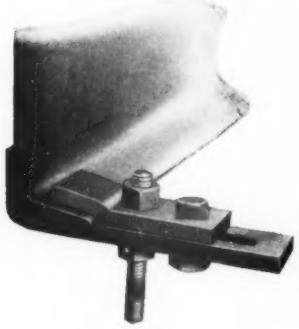
Here Are Five Devices
In the Steel City-Kindorf Line
That Help Do Better Jobs Quicker
In Conduit Installations

No. 160 Adjustable Beam Clamp



A Beam Clamp adjustable to flange thickness, with a long threaded Hook Rod adjustable to a wide range of beam sizes. It permits easy Hanger Rod adjustment and is load-rated 500 pounds with a safety factor of five (5).

No. 177 Adjustable Channel Clamp



This clamp is adjustable to all structural channels with maximum flange width of 3-1/2". It is also adjustable to fit any structural angles with leg up to 3/8" thick. Its load rating is 500 pounds.

No. 150 Conduit Hanger



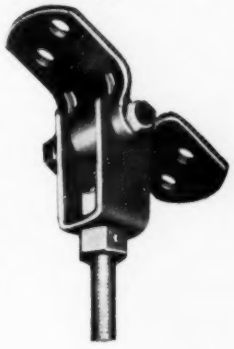
Hangers for suspending all sizes of conduit, providing temporary support during installation. The vertical adjustment range is 1-1/2" or more, and when conduit is in place, Hanger Bolt is inserted into slot and nut (which has not been removed) is tightened, locking into position.

No. 165 Adjustable Beam Clamp With Swing Connector



This Beam Clamp is identical with No. 160 with addition of a Swing Connector which eliminates bending of Hanger Rod when suspending from purlins. Swivel Bolt is furnished with patented lock nut which permits free movement, but safely holds bolt in place.

No. 170 Adjustable Swinging Hanger Flange



This flange with four 13/32" holes can be installed with wood screws or 3/8" bolts. With it is furnished Swivel bolt with patented Lock Nut as used No. 165. Hanger Rod Nut locks in position. It is load-rated up to 1200 pounds—depending upon strength of wood screws used.

STEEL CITY-KINDORF LINE

of Clamps, Hangers and Supports has been designed from a thorough understanding of their requirements and to enable the electrician to make conduit installations—from the simplest to the most complex—in an easy and low-cost manner, with a neat, workmanlike appearance. Write for any information desired.

STEEL CITY ELECTRIC CO.

PITTSBURGH 33 PENNSYLVANIA

ELECTRICAL BOXES AND CONDUIT FITTINGS

KINDORF DEVICES FOR INSTALLING CONDUIT



HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by Graybar

NEW More Versatile Line of Lighting Units and Fixtures by STEBER

STEBERLITES



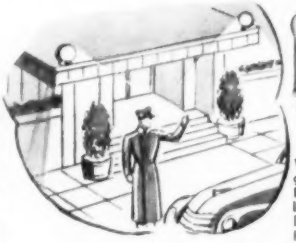
S-300
Cast aluminum Steberlites for PAR 38 and R-40 sealed beam lamps (Medium and Mogul base) are compact, weatherproof, fully wired. Mount singly or in clusters up to eight. Universal aiming adjustment.



Economical, easy to install Steberlite Units and mounting fixtures cut installation time, reduce labor and wiring costs. The new wider selection of versatile fittings provides quicker, easier mounting of single or clusters of Steberlites in any location and for any purpose. This greater *adaptability* of the Steber line makes it more profitable for contractors and dealers alike. Bulletin #120-53 illustrates and describes the latest Units. A copy is yours on request.



S-400
For PAR 56, 80,000 C.P., 300 watt lamp. Finned cast aluminum weatherproof construction. Factory wired ready to mount singly or in clusters. Universal aiming. Available with or without heat resistant lens.



Listed by Underwriters' Laboratories



S-360
New close coupled Steberlite with ½" thread to fit all Steber cluster and unit mountings. Universal aiming. Wired — including lamp gasket. Uses medium base PAR-38 and R-40 sealed beam lamps. S-370 Steberlite — 45° fixed position. Has ½" removable nipple. Ideal for illuminating signs and billboards or any fixed position outdoor lighting purpose.



S-342
New through-the-wall hub flange adaptor for two lamp cluster. (Also furnished for one and three lamps). One inch O.D. hub extends 1" from base of flange and has ½" thread for connection to pipe, conduit or outlet box to utilize inside power supply.

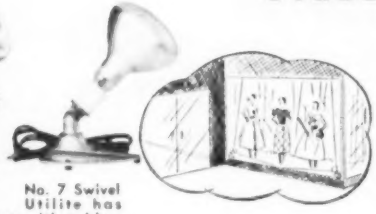


S-327
New pole top cluster fitting of cast aluminum fits pole tops from 1" to 2". Six ½" tapped openings and gasketed cover with ½" threaded opening to mount up to seven Steberlites. Round-type ample wiring compartment. Three bolts anchor unit to pole top.

STEBER UTILITES



No. 2 Utilite for spot or floodlighting indoors or out.



No. 7 Swivel Utilite has heavy base with rubber bumpers to protect mounting surface. Also holes in base for permanent mounting.

The ideal unit to serve hundreds of uses indoors and out. Steber Utilites provide handy utility lighting wherever a safe portable light is needed. Universal aiming adjustment for decorative, safety, play or odd job lighting. Nearly 5 million Utilites are already in use. Complete with 6' cord and plug. Constructed of rustproofed steel or cast aluminum. Colorful display free with standard package of 12 units. Listed by Underwriters' Laboratories, Inc. Write for Bulletin #121-50.



No. 8 Swivel Utilite

STEBER FLOODLIGHTS



Series 57



Series 4000



Series 1600

The complete Steber line of Floodlights meets nearly every requirement. They are used in and around industrial property, parking lots, railroad yards, schools, hospitals, commercial establishments, automotive service stations and residential areas.

Steber Floodlights are available in open or enclosed types for 100 to 1500 watt lamps. A complete selection of mounting brackets is available to meet every application.

Floodlight Bulletin gives complete details.

Listed by Underwriters' Laboratories, Inc.



Series 2500

STEBER **STEBER MANUFACTURING CO.**
Dept. 99, Broadview (Maywood P.O.), Illinois



HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by Graybar



Pull Any Size Pole *Easier*

with the NEW *Light-Weight*

SIMPLEX ALUMINUM POLE JACK

No. A-1538

15 Ton Capacity . . . WEIGHS ONLY 60 POUNDS!

POWERFUL! RUGGED! DEPENDABLE!

Here's the first time and labor saving improvement in pole jacking in 25 years! New aluminum housing on The Simplex heavy-duty Pole Jack eliminates 35 pounds of weight, without sacrificing a pound of lifting capacity. You can pull or straighten poles, pull butts or move loaded poles without interruption to service—and without digging. Only 60 pounds in weight, it's easy to move from job to job; saves time and work.

This new Simplex No. A-1538 Aluminum Pole Jack has the better-performance and long-lasting construction features that made its predecessor—the famous Simplex No. 329 with malleable housing—the standard Pole Jack of the Bell Systems. The husky "I" beam base gives a firm foundation; jack pivots on the base when pawl is disengaged. The A-1538 has 15-ton capacity and 22-inch lift. Comes completly equipped with steel chain and lever bar.



CABLE REEL JACKS
Double-acting and single-acting ratchet lever types or screw type. One to 10-ton capacities. Field model available soon with light-weight aluminum housing.

AERIAL CABLE AND WIRE TENSIONING JACK



MANHOLE SHEAVE
Handles up to 3-inches diameter cable or any size winch line.

JUNIOR POLE JACK NO. 325
Pulls or straightens poles up to 30 feet high. 5-ton capacity.

Get full information now from your Graybar Branch, or write for Catalog No. 50

Simplex
LEVER - SCREW - HYDRAULIC
Jacks

TEMPLETON, KENLY & COMPANY
1020 South Central Avenue, Chicago 44, Illinois





HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA **GRAYBAR**

Distributed by Graybar

TAL PORTABLE BENDERS

BEND THINWALL or RIGID CONDUIT FASTER



Tal Benders available in all sizes from 1" up—maximum size 8".

MAKE PERFECT BENDS IN ONE OPERATION

You can earn bigger profits by reducing up to 80% the number of elbows and couplings otherwise needed. Save on cutting, threading and installing. This is possible with a Tal, because Tal Portable Benders make any degree bend in ONE SETTING WITHOUT SHIFTING THE CONDUIT . . . and do the job faster!

No guesswork for offsets, long sweeps or any other bends. No experience necessary to make accurate, wrinkle-free bends quickly, right on the job.

No spoilage. Bend indicator assures identical repeat bends without measuring.

Actual bending time of a 90° bend in 3" conduit with a motorized Tal Bender—1 minute, 51 seconds. Other sizes in proportion. Assembly time of a Tal Bender (2 parts only)—less than 1 minute.

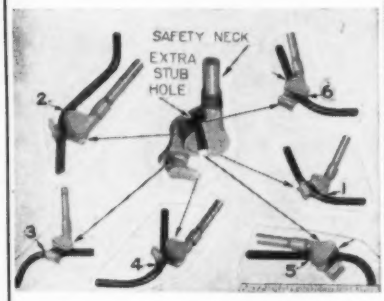
Learn today how you can earn more money and handle more jobs with a Tal Portable Bender.

Electrical Contractors from all over the country tell us their biggest jobs are installed without manufactured ells. Everything is bent at considerable savings because *only* TAL "ONE-SETTING" BENDERS are used:

- Magaw Electric Co., Milwaukee
- Hatfield Electric Co., Indianapolis
- Evans Electrical Construction Company, Kansas City
- Sanborn Electric Co., Indianapolis
- Edward P. Allison Co., Chicago
- Miller Electric Co., Jacksonville

TAL 6-WAY HICKEY FOR RIGID CONDUIT

Exclusive design of the six non-slip bending jaws assures perfect elbows, offsets, loops, saddles, stubs and sets in close quarters or on open slab work. No effort, no kinks. The bending jaw grooves of this "Safety-First Hickey" are slip-proof, and long safety neck prevents it from breaking at the threads. Has extra stub hole for bending conduit protruding from concrete. *Guaranteed for life against breakage.*



Nos.	Size	Weight
50	½"	3½ lbs.
75	¾"	5 lbs.
100	1"	8½ lbs.

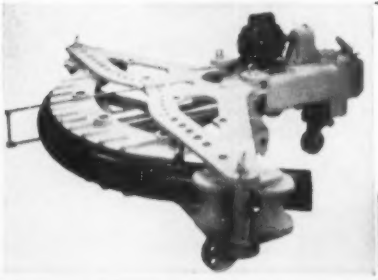
Nos.	Package Price of Ten	Unit Price
50	$3.10 ea.	$3.70 ea.
75	3.90 ea.	4.65 ea.
	Package Price of Three	
100	6.65 ea.	7.95 ea.

"HANDY-BENDY" for Thinwall (EMT) & Rigid Conduit



Perfect bends up to 90° in thinwall (EMT) and rigid conduit with one pull . . . No kinks, no flattening, no other distortion.

"Handy-Bendy" is light in weight (31 lbs.), fast, can be used on the job or in the shop. Bends accurately to any height or degree-of-bend. Gauges are set instantly and easily. Thinwall and rigid conduit bending formers for ½" and ¾" sizes standard equipment. A great money saver when used on open or slab work, or any other jobs requiring many identical bends.



COMPLETE LINE OF BENDERS

Portable hydraulic benders for rigid conduit to 5" and thinwall conduit 1"—2" . . . Small combination hand operated bender for both rigid and thinwall conduit ½"—¾".

WRITE FOR THIS FREE BULLETIN



Tal Bender, Inc. Dept. 21 Milwaukee 2, Wis.



HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by GRAYBAR ELECTRIC COMPANY

How to speed wiring jobs with 2020 connectors

T&B ENGINEERED

With T & B 2020 connectors you can substantially reduce the time it usually takes to wire boxes and hook up portable cords using ordinary locknut-type connectors.

Just an easy finger squeeze — that's all it takes to snap a T & B 2020 connector into the box. Deep body grooves hold the connector in ½-inch knockouts while the one-screw tightening clamp grips the cable tightly without damage to insulation — there are no loose parts to handle . . . no locknuts to lose.

The wide-range adjustability and smooth, firm grip of the T & B 2020 connector cable clamp makes it ideal for use on portable cords and small-diameter, plastic-sheathed cables as well as standard non-metallic sheathed cable in sizes 14-2 to 10-3; 2 or 3 wire. The 2020 connector is fully approved by the Underwriters' Laboratory. For complete details send for descriptive folder.



T & B 2020 CONNECTOR
(for non-metallic sheathed cable)



Installs from **OUTSIDE OR INSIDE** a junction box.

Designed for installation from either *inside or outside* of the box, the patented T & B 2020 connector is particularly well-suited for work in old buildings. Working from the inside eliminates much of the damage often done to adjacent floors or walls . . . you keep costs to a minimum.

T-317

LOOK FOR THIS SIGN — T&B ENGINEERED

IT'S THE MARK OF AN AUTHORIZED T & B DISTRIBUTOR

The complete line of T & B fittings for conductors and raceways is sold only by recognized electrical wholesalers. It's our way of assuring you the service and savings of a friendly local source. Call him for all your electrical needs.

THE THOMAS & BETTS CO.

INCORPORATED

34 Butler Street • Elizabeth 1, New Jersey

Thomas & Betts Ltd., Montreal, P.Q., Canada

MANUFACTURERS OF FINE ELECTRICAL FITTINGS SINCE 1898



HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by Graybar



Southern Wisconsin Colony and Training School, Custodial and Employees Buildings, Union Grove, Wisconsin.
Roger C. Kirchhoff, Madison, *State Architect.*
Wm. B. Herbst Associates, Milwaukee, *Architects.*
H. H. Witte, Madison, *Resident Engineer.*
Siesel Construction Co., Milwaukee, *General Contractors.*
Dave Speaker Company, Kenosha, *Electrical Contractors.*

Goes in Smoothly on Concrete-Slab Jobs...

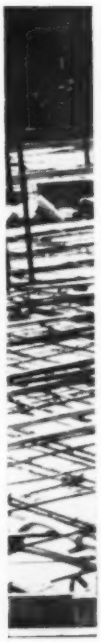
REPUBLIC

The "Inch-Marked®" E.M.T.

Zinc protected surface from end to end . . . no lengths to turn . . . ELECTRUNITE E.M.T. is easily joined with quickly-applied couplings and connectors. Tight joints are readily made with simple tools without disturbing the galvanizing.

Republic ELECTRUNITE E.M.T. is uniformly strong and is ductile for easy bending. The exclusive "Inch-Marked" feature enables journeymen to cut and bend ELECTRUNITE E.M.T. accurately without measuring the tube. Exclusive *inside-knurling* speeds wire-pulling.

Electrical circuits cased in Republic ELECTRUNITE "Inch-Marked®" E.M.T. are protected against moisture, fire, and mechanical injury. For all types of construction . . . concealed, exposed, and concrete slab, install Republic ELECTRUNITE E.M.T. . . . it's "Inch-Marked" for your greater convenience.



STEEL AND TUBES DIVISION
REPUBLIC STEEL CORPORATION
212 EAST 131st STREET • CLEVELAND 8, OHIO

Republic
REPUBLIC STEEL
ELECTRUNITE E.M.T.



HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA
GRAYBAR

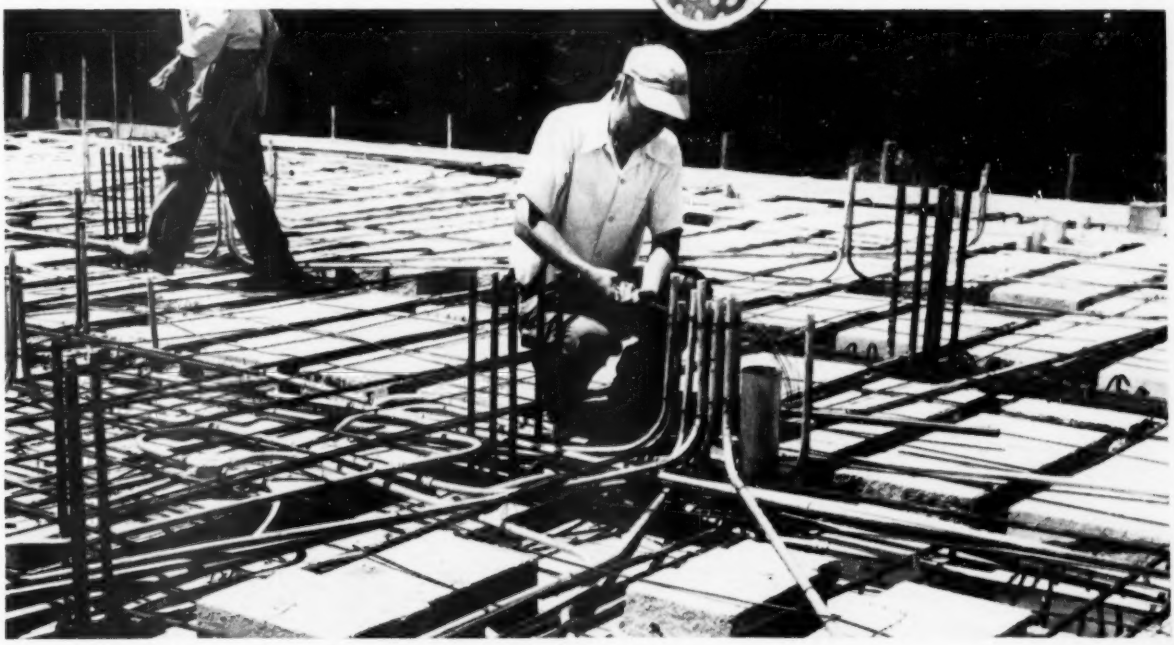
Distributed by GRAYBAR



After the pour, stubs fully protected with galvanizing are easily joined when completing the runs.



ELECTRUNITE



In locations where multiple runs are grouped and space is limited, it's easier to install this modern, electrical raceway system.



HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by GRAYBAR

Through Research, Tomic adds something NEW!



PRE-FLEXED LOCK WASHERS

TOMIC FITTINGS NOW WITH

Pat. No. 2458276



SLIPS ON TUBE WITH THE GREATEST OF EASE!

MUCH EASIER TO INSTALL!

PROVIDES MORE PERFECT BOND!

GREATER PULL TEST!

MAIL COUPON FOR FREE SAMPLE

Tomic Sales & Engineering Co.
4864 Woodward Ave., Detroit 1, Michigan

Please send me sample of Tomic Fitting with pre-flexed lock washer.

Name _____

Address _____

City, Zone, State _____ ECM

Lock washers are now pre-flexed at the factory to make your jobs easier . . . to make Tomic Fittings the best in the business!

TOMIC SALES & ENGINEERING CO.

4864 Woodward Ave. • Detroit 1, Michigan



HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by Graybar Electric Company

DEPENDABLE POWER



FOR DRILLING HOLES IN STEEL . . . WOOD . . . MASONRY

Standard in industry since portable power drills were first developed, the name THOR has stood for DEPENDABLE POWER for over 59 years!

The new Thor "Silver Line" Electric Drills are available in 39 sizes, styles and speeds to meet every shop and field requirement. YOU NAME IT, THOR HAS IT . . . .

Improved motor . . . all ball-bearing construction . . . die-cast precision-fitted housings . . . PLUS an endless list of "extras"—these are the penny-savers and dollar-savers that make Silver Line Drills your best buy today!

Factory branch sales and service in principal cities. Free 1953 catalog upon request. Thor Power Tool Company Aurora, Ill.

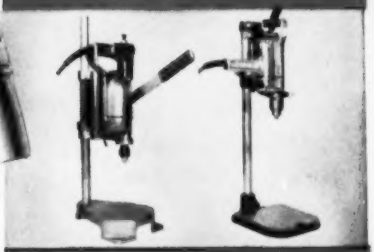
Thor PORTABLE POWER TOOLS



MOST POWERFUL ½" DRILL ON THE MARKET—Mining companies use this tool with carbide bits to drill 1¼" holes in *solid rock!*



THOUSANDS OF THOR DRILLS in use today in any industry you can name — selected by purchasing agents and tool superintendents for DEPENDABLE POWER!



DRILL STANDS for all sizes convert portable drills to stationary use as powerful-leverage drill presses.



THOR SERVICE STATIONS IN PRINCIPAL CITIES make fast, factory-standard repairs when tool parts wear.

GET IT FROM YOUR JOBBER

IMPACT WRENCHES • SAWS • HAMMERS • DRILLS
AUTOMOTIVE VALVE SHOP TOOLS • SANDERS • POLISHERS
SCREWDRIVERS • NUT SETTERS • SANDERS • NIBBLERS

BUY IT from your DISTRIBUTOR



HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by GraybaR

HOW CAN A *Friendly* MANUFACTURER HELP YOU IN YOUR BUSINESS?



We at Triangle have an old fashioned idea that what we and our distributors can give you—friendship, help, cooperation, is sometimes more important than the wire, cable or conduit we sell you.

That feeling is strengthened every time we get a letter saying, "You and your distributors sure helped us out of a jam" or "We can't help but tell you how much we appreciate your cooperation."

When you constantly get such comments, you know that a lot of people like you are profiting from doing business with Triangle. Perhaps you too will find that things run smoother when you do business with Triangle.

Here are some of the things our field men, in cooperation with a nation-wide network of top electrical distributors, give, every working day—and many a night!

- Expert, friendly counsel on how to get the most and best wire, cable and conduit for your money.
- Expert engineering assistance at any point of the job—and for as long after as you choose.
- An expediting service famed for its helpfulness. We're not supermen, but if it can be done, we'll do it.
- Printed material—calculators, wiring manuals and other literature useful to you many times during the year.
- A spirit of friendliness and helpfulness that will make you feel comfortable when dealing with Triangle.

No matter who you are—contractor, engineer, maintenance man—no matter who you work for—utility, city, contracting firm, large industrial—

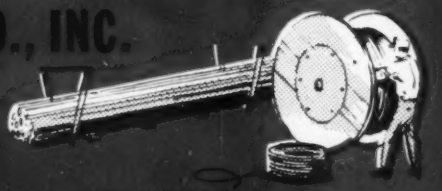
YOU'LL LIKE DOING BUSINESS WITH TRIANGLE!

TRIANGLE

The Trade Mark of Triangle

TRIANGLE CONDUIT & CABLE CO., INC.

NEW BRUNSWICK, NEW JERSEY



WHEN IT'S A QUESTION OF CARRYING ELECTRICAL POWER, CALL FOR TRIANGLE



HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

GRAYBAR Distributed by Graybar Electric Company



TILDEN
KARRYING KITS

KIT E — ELECTRICIANS

1 — 1/4″
1 — 3/8″
1 — 1/2″
1 — 3/4″
1 — 1″
1 — 1 1/4″

KIT A

Kit Size 9 3/4″ x 5 3/4″, six pockets

1 — 3/16″
1 — 1/4″
1 — 3/8″
1 — 1/2″
1 — 5/8″
1 — 3/4″

KIT B

Kit Size 9 3/4″ x 3 1/2″, three pockets, Holds up to 13/16″.

1 — 1/4″
1 — 3/8″
1 — 1/2″

There is no extra charge for kits. You pay only for the drills.

Only the most used drill sizes included in kits.

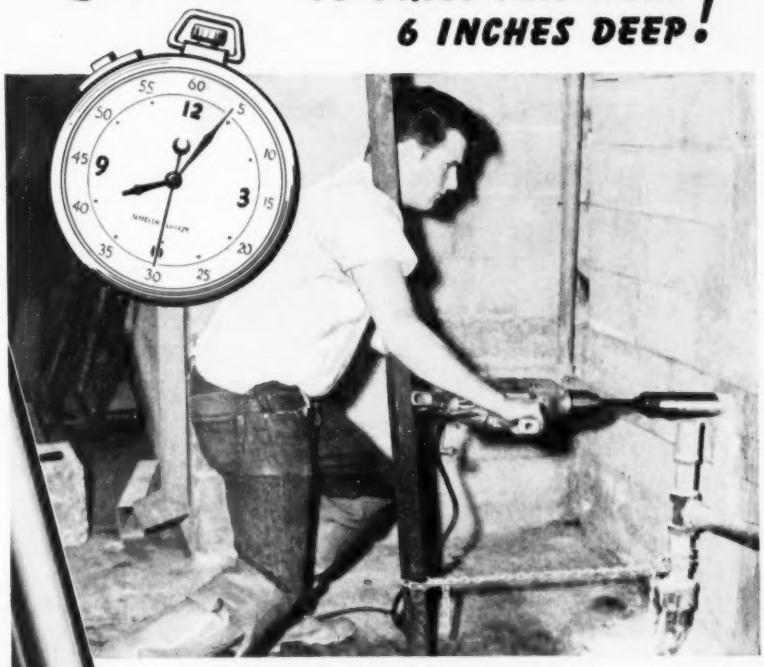
Kits are a safe, easy way for a user to carry his drills and protect them from damage.

Kit has sturdy leatherette back, plastic pockets. Ideal for tool box.

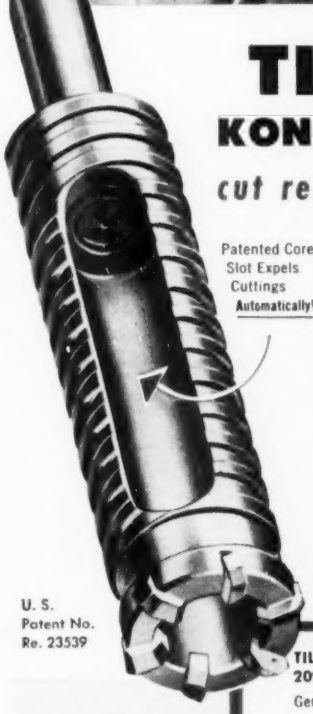
May be sold with special sets of drills if desired.

Kits sold packed with drills only.

4 1/2 MINUTES
TO DRILL THIS HOLE 6 INCHES DEEP!



TILDEN ROTARY
KONKRETE KORE DRILLS
cut reinforcing rods in concrete!



Under the actual on-the-job conditions shown above, a Tilden 2 1/2″ diameter Rotary Konkrete Kore Drill cut through 6″ of concrete—including crossed steel reinforcing rods—*in just 4 1/2 minutes!* The straight, clean, ready-to-use holes permitted immediate running of 2″ pipe. You consistently get 5 to 7 times more holes without resharpening with a Tilden Drill—and free factory sharpening is still available on sizes from 3/16″ to 4″ diameters. Tilden Drills can be used with ordinary electric or rotary air motors. Interchangeable shanks are available for any depth hole.

Find out about this revolutionary drill TODAY! Consult our Engineering Department without obligation, on your drilling problems.

U. S. Patent No. Re. 23539

***WRITE TODAY** for free illustrated catalog. Please describe your drilling problem in detail.*

TILDEN TOOL MANUFACTURING COMPANY
209 Los Molinos, San Clemente, Calif.

Gentlemen: Please send me without obligation, complete information on the Rotary Konkrete Kore Drill.

Name _____ Title _____

Company _____

Address _____



HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by Graybar

Another Major Plant meets WITH FLEX-A-POWER

Provision for future needs is just as important as meeting present electrical distribution requirements in modern factories and office buildings.

You can count on the fact that loads will increase substantially over the years — and that continued efficiency of the building will depend on complete freedom to change layout, add or move electrically operated equipment, rearrange circuits, or even make additions to the building itself.

Trumbull pioneered Flex-A-Power bus systems which make equipment relocations or additions almost as simple as plugging in a toaster, and the addition of load or major alterations swift and simple.

The initial installed cost of Flex-A-Power is often *below* that of wire and conduit, but this substantial saving is minor compared with permanent reduction of down time, ability to make desired alterations for efficient layout, or make mobile take-offs from your power systems.

Your Trumbull distributor, backed by nearby Trumbull engineering personnel, can give you authoritative information, prompt quotations and speedy delivery. Or write for a more detailed description of Trumbull Flex-A-Power systems.

New 14-acre plant of Hamilton Standard Division, United Aircraft Corporation, incorporated a complete Trumbull Flex-A-Power electrical distribution system, which helped to effect a major move with minimum loss of production time.

Electrical Contractor: Lord Electric Co., Boston
Distributor: Graybar Electric Co., Boston
Architect: Albert Kahn, Inc., Detroit
General Contractor: Turner Construction Co., Boston





HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

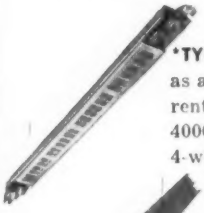
Distributed by Graybar

present and future power requirements



Quick Facts

About 4 types of Flex-A-Power which, in combination, will meet almost any low voltage distribution requirement.



*TYPE LVD. For high capacity feeder applications, or as a riser in multi-story buildings carrying high currents over long distances, with low voltage drop. 600-4000 ampere ratings, 2-, 3- and 4-pole and 3-phase, 4-wire solid neutral, 600 volts.



*TYPE FVK. Operates like a panelboard running the length of the plant. Power outlets at one-foot intervals, tapped by Flex-A-Plug fusible switches or breakers. 225-1000 amperes, 2- and 3-pole and 3-phase, 4-wire solid neutral, 600 volts.



TYPE TK. A heavy-duty trolley busway, brings *mobile* power to production lines, hoists and cranes. 100, 200 and 400 amperes, 2- and 3-pole, 600 volts.



TYPE LTG. A plug-in and trolley busway, unmatched for lighting systems. Individual lights or entire systems can be rearranged with plug-in ease. Portable tools enlarge their usefulness by means of LTG plugs or trolleys. 50-amperes, 2-, 3- and 4-pole, 300 volts.

**Aluminum busbars optional.*

OTHER RECENT FLEX-A-POWER INSTALLATIONS

SHAMROCK HOTEL,
Houston, Texas

UNITED NATIONS BUILDING

SEALED POWER CORPORATION,
Rochester, Indiana

GIMBEL'S MILWAUKEE STORE

HOTEL ROOSEVELT,
New Orleans, Louisiana

UNIVERSITY OF WASHINGTON MEDICAL SCHOOL,
Seattle, Washington

REMINGTON RAND LABORATORY,
Norwalk, Connecticut

STANDARD KNAPP DIVISION,
Emhart Mfg. Company,
Portland, Connecticut

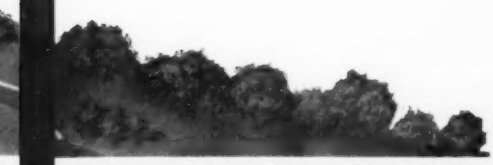
CANDLER BUILDING,
Atlanta, Georgia

HARTFORD FIRE INSURANCE CO.,
Hartford, Connecticut

CITY NATIONAL BANK,
Houston, Texas

TRUMBULL (T) ELECTRIC

DEPARTMENT OF GENERAL ELECTRIC COMPANY
PLAINVILLE, CONN.





HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Graybar Distributed by Graybar Electric Company

USED FOR THEIR QUALITY

Across the Country



WAGNER Malleable Electrical Fittings are tough, accurately cast, precision threaded, perfectly finished and quality inspected. Every step in their production is done in our own foundry under complete chemical laboratory control.

There never is a variance in the quality whether a few or many of one kind is ordered.

FROM MOLTEN METAL TO FINISHED PRODUCT

WAGNER MALLEABLE PRODUCTS COMPANY

222 W. Adams St. Chicago 6, Illinois
Foundry and Plant Decatur 60, Illinois

WAGNER MALLEABLE FITTINGS



HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA
GRAYBAR

Distributed by Graybar

UNITED STATES RUBBER COMPANY

OUTSTANDING IN INSULATION

U. S. Electrical Wires and Cables

LAYTEX® RUH-RUW—The world's smallest diameter, lightest weight natural rubber-covered power and lighting wire.

NEOLAY® RU—With Laytex Insulation plus Neoprene. Nylon cover makes pulling five times easier.

CONTROL CABLE—Insulated with Laytex for greater circuit integrity.

NEOPRENE COVERED SERVICE ENTRANCE CABLE—Flame retardant, moisture resistant—the first ever accepted by Underwriters' Laboratories, Inc.

MUNICIPAL SIGNAL CABLES—Insulated with Laytex for maximum moisture resistance.

POWER CABLES—Of every description, including the famous Grizzly® line of tough cables.

ALUMINUM WIRES AND CABLES—U. S. Rubber introduced insulated aluminum conductors.

ELECTRIX® PLUGS—U. S. Rubber was a pioneer in the development of soft rubber plugs for extension cord sets and power supply cords. (Also all rubber cube taps.)

ROYAL PORTABLE CORDS AND CABLES—And many other types of electrical wires and cables.

ROYAL MINING MACHINE & LOCOMOTIVE CABLES—Tested many different ways to insure complete dependability.

INTERCOMMUNICATION CABLE—With thermoplastic insulation and jacket making this cable flameproof throughout.

TWISTED SERVICE DROP CABLE—Either neoprene insulated or performance insulation and neoprene jacket; copper or aluminum conductors.

UNITED STATES RUBBER COMPANY · ELECTRICAL WIRE & CABLE DEPARTMENT

1230 Avenue of the Americas · Rockefeller Center, New York 20, N. Y.



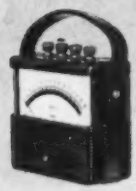
HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by GraybaR



Model 622 – Ultra-Sensitive Instruments

Portable d-c and a-c thermo instruments for precision measurement of potentials and minute currents in electronics or laboratory research.



Model 901
Portable Test Instruments

Available in d-c, Model 901 –and a-c, Model 904, single and multiple ranges of wide coverage. Excellent scale readability and shielding. Accuracy within ½ of 1%.



A-C Clamp Volt-Ammeter

(Model 633, Type VA-1) For convenient and rapid measurement of a-c voltage and current without breaking the circuit. Jaws take insulated or non-insulated conductors up to 2" diameter. Safe, rugged, versatile. Also available as a-c clamp ammeter, without voltage ranges.

Specialized and Multi-purpose

INSTRUMENTS

for

- **RESEARCH**
- **PRODUCTION**
- **MAINTENANCE**

For complex, or just routine measurement jobs, these and other specialized WESTON Instruments save time and assure dependable measurements. For information on the complete line, see your local Weston representative, or write . . . WESTON Electrical Instrument Corp., 614 Frelinghuysen Ave., Newark 5, N. J.

WESTON
Instruments



Sensitive Relays

A line of sensitive relays including the Model 705 which provides positive operation at levels as low as ½ microampere. Non-chattering magnetic contacts handle up to 10 watts at 120 volts.



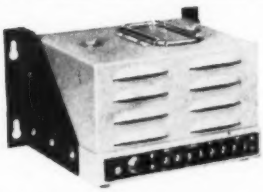
Panel and Switchboard Instruments

A complete line of instruments in all types, sizes and ranges required for switchboard and panel needs . . . including d-c, a-c power frequencies and radio frequency, rectifier types and D.B. meters.



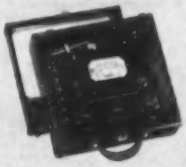
Model 697 Volt-Ohm-Milliammeter

One of a line of pocket-size meters, Model 697 combines a selection of a-c and d-c current, and resistance ranges. Ideal for maintenance testing and many inspection requirements.



Model 1411 Inductronic D-C Amplifier

Stable amplifier provides high degree of resolution even at fractional loads. Reaches steady full scale deflection in a fraction of a second. Interchangeable plug-in range standards for either microamperes or millivolts.



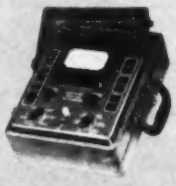
Industrial Circuit Tester – Model 785

A multi-range, multi-purpose, ultra-sensitive analyzer, for laboratory and industrial checking of electrical and electronic circuits. Has 28 practical scale ranges; measures d-c and a-c voltage, d-c and a-c current, and resistance. Accessories available to extend ranges. Compact and portable; furnished in either oak or steel case.



Model 686
Electronic Tube Analyzer

Tests tubes under exact operating potentials. Accurately determines true mutual conductance of all tubes, In accordance with manufacturers' rated operating conditions, or under special operating conditions.



High Frequency Electronic Analyzer
Model 769

A three-in-one instrument providing a self-contained Volt-Ohm-Milliammeter, a high impedance electronic D-C Volt-Ohmmeter, and a probe type Vacuum Tube Voltmeter for use to 300 megacycles. Exceptionally stable and accurate. Has specially designed extremely small RF and D-C probes.



HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by GRAYBAR



Electrical Contractor:
S. P. Electric Company
2850 N. Oakland Avenue
Milwaukee, Wisconsin

Installation:
Lincoln School
Jefferson School
Wauwatosa, Wisconsin

Contractor does first installation of Rapid Start Lamps with Wakefield Pacemakers

Eight hundred Wakefield Pacemaker luminaires were recently installed in the Lincoln and Jefferson Schools at Wauwatosa, Wisconsin. All were equipped with new Rapid Start lamps. Here's what Electrical Contractor Gene Kasal of S. P. Electric Company says about the installation:

"We favor Rapid Start operation because it is simpler and the ballasts are quiet. Both my men and my client will benefit from this improvement.

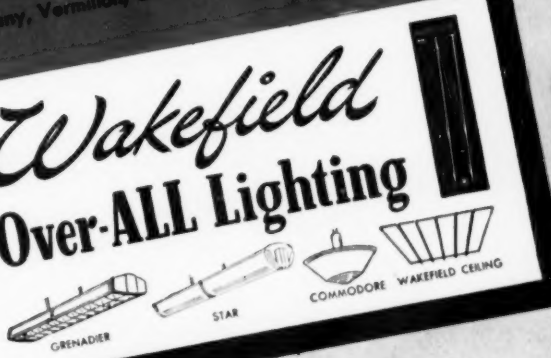
"Incidentally, we were gratified to be able to supply fixtures with Rapid Start lamps so soon after they came on the market. We understand that this installation of Wakefield Pacemakers with Rapid Start lamps is the first anywhere. I feel the Wakefield people are to be congratulated for their promptness in equipping their fixtures for Rapid Start operation."

The Wakefield Pacemakers were supplied with 20" suspension, with louvers that provide 45° longitudinal shielding, and were installed in three rows. Although these luminaires were made for Rapid Start lamps, they are also available for use with standard pre-heat bipin or slimline lamps.

There's a Wakefield resident lighting specialist near you, who will be pleased to help you plan an installation. For information on Wakefield Luminaires, write The F. W. Wakefield Brass Company, Vermilion, Ohio.

Designed for Contractors by...

Wakefield Over-ALL Lighting





HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by Graybar

PLUGMOLD 2000 is the EASIEST, FASTEST, CHEAPEST way to provide MULTIPLE CONVENIENCE OUTLETS!

All over the country, installations of Plugmold 2000 in factories, offices, hospitals, stores, homes — in every type of building, new and old—have demonstrated this fact: you can provide the multiple outlets that everybody wants, more easily, more quickly and at less cost with Plugmold 2000.

Plugmold 2000 is easily mounted on any surface. You install it in one long, continuous run — no multiple connections of a lot of short lengths! You can feed into the Plugmold 2000 raceway at *any* convenient point — there are ½" knock-outs for feeding every 7½" — no special fitting is needed; all you need is any standard squeeze connector for armored cable.

Plugmold 2000 provides a duplex or a NEMA grounded outlet every 30 inches. 18", 6" and even closer spacings in clusters, are available in factory-wired sections. Duplex receptacles are available with both sides "hot", or with one side "hot" and one side switched.



FACTORIES

OFFICES

STORES

SCHOOLS


HOMES

Example:

—in Toledo, PLUGMOLD 2000 is providing GREATER SALABILITY for 368 homes in the DON SCHOLZ CONSTRUCTION CORPORATION'S NEW DEVELOPMENT!

- Plugmold provides 3 times as many outlets at same cost as ordinary wiring—faster, cheaper, easier to install!
- Plugmold 2000 provides complete flexibility for much more attractive room arrangements!

PLUGMOLD will do the SAME for YOU!

Write today for the new Plugmold Booklet and complete installation instructions!

WIREMOLD

Makers of
PLUGMOLD—multi-outlet systems
WIREMOLD—electrical raceways
PANCAKE—overfloor raceways

THE WIREMOLD COMPANY | Hartford 10, Conn.



HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

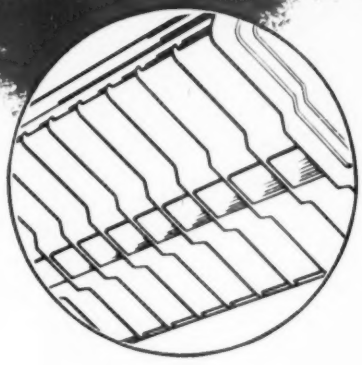
Distributed by Graybar

Years Ahead IN DESIGN

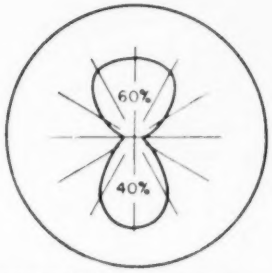
Wheeler FLO-LINER



THE NEWEST ADVANCE IN FLUORESCENT LIGHTING FIXTURES FOR SCHOOLS, OFFICES, STORES AND PUBLIC BUILDINGS



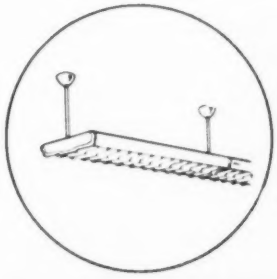
Tomorrow's fixture *today* — the new Wheeler FLO-LINER combines high efficiency and smart styling with unique maintenance ease and economy. When detached, louver assembly is automatically suspended below channel by supporting chains — allows quick, easy access to operating equipment. Amazingly flexible — 2 lamp and 4 lamp units available for both single pin and bi-pin lamps!



45° CROSSWISE SHIELDING — provided by the unique use of a plastic center panel which gives comfortable shielding to this shallow, smartly styled unit.

85% EFFICIENCY — translucent plastic side panels and center panel give low brightness for more comfortable seeing and high efficiency. For further seeing comfort, 51% of the light is directed above the horizontal and 34% below.

Write for special **FLO-LINER** *bulletin*



EASILY JOINED — in continuous rows by simply joining ends together with two screws which are supplied. Units may be suspended from pendant stems or attached directly to ceiling.

Wheeler

Distributed Exclusively Through Electrical Wholesalers
WHEELER REFLECTOR COMPANY
275 Congress Street Boston 10, Massachusetts
REPRESENTATIVES IN PRINCIPAL CITIES



HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA **GRAYBAR**

Graybar Distributed by Graybar

LOOK! less burring with Youngstown Buckeye Conduit



HERE'S WHAT A CONTRACTOR SAYS ABOUT CONDUIT: "We electrical contractors prefer the conduit that gives us a minimum of burring. The fewer burrs, the more hours I save on reaming time. Buckeye Conduit gives a contractor a chance to cut installation costs. That's why I like it."



ELECTRICAL ENGINEER PRAISES BUCKEYE CONDUIT: "From experience I've found that contractors protect wires better if they use Buckeye. Youngstown makes rigid steel conduit from start to finish. This assures a quality control of manufacture and thus better steel. That is why Buckeye cuts easier and creates fewer burrs."

Take a tip from electrical men! Get Buckeye Conduit for a **minimum** of burrs and a maximum of protection.
Shipments of Buckeye rigid steel conduit are now being made from our conduit mills at Indiana Harbor and Youngstown.

THE YOUNGSTOWN SHEET AND TUBE COMPANY

General Offices — Youngstown 1, Ohio

Manufacturers of Carbon, Alloy and Yoloy Steel

Export Office - 500 Fifth Avenue, New York

COLD FINISHED CARBON AND ALLOY BARS · ELECTROLYTIC TIN PLATE · COKE TIN PLATE · WIRE · PIPE AND TUBULAR PRODUCTS · CONDUIT · RODS · SHEETS · PLATES · BARS · RAILROAD TRACK SPIKES.



HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

Distributed by GraybaR



This is IT!

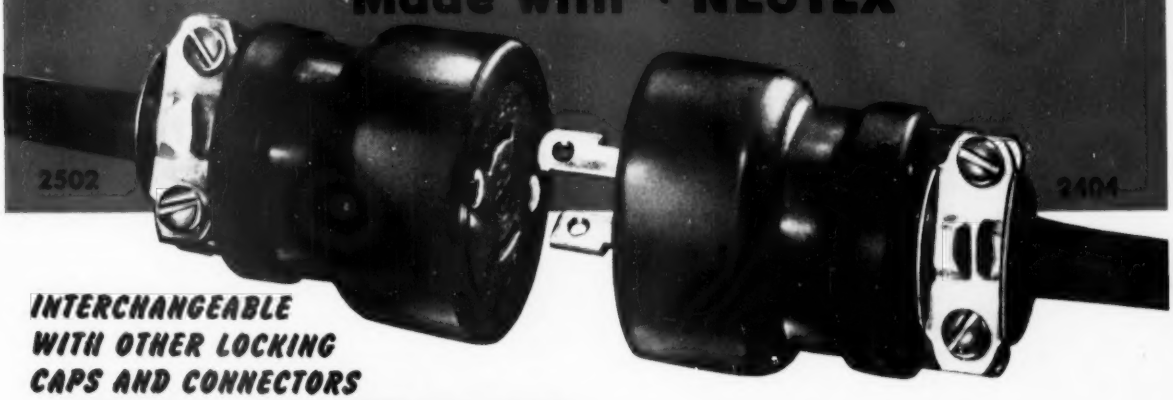
the New

DANIEL WOODHEAD

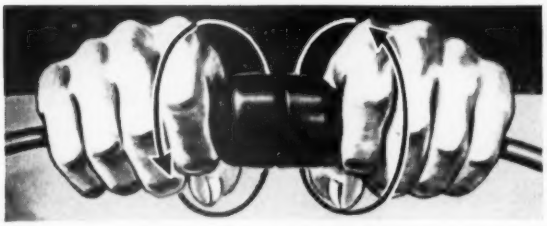
TURNEX

LOCKING PLUG CAP AND CONNECTOR

Made with *NEōTEX



INTERCHANGEABLE WITH OTHER LOCKING CAPS AND CONNECTORS



TURN . . . IT LOCKS

Heavy duty NEoTEX cover . . . molded-in cord grip for heavier cords . . . laminated phenolic inserts . . . extra heavy brass contacts . . . can be subjected to the most severe service.

***NEōTEX**—a Synthetic Rubber Compound, Completely Resistant to the Effects of Oils, Greases and Most Chemicals.

***NEōTEX**—More Than Ever Before . . . NEoTEX Makes DANIEL WOODHEAD PRODUCTS the Outstanding Maintenance Devices for Industry.

***NEōTEX**—Developed by DANIEL WOODHEAD COMPANY in its own Complete Rubber Plant.

When You See This Trademark DW You Can Be Sure of the Best

DANIEL WOODHEAD COMPANY 15 N. JEFFERSON ST., CHICAGO

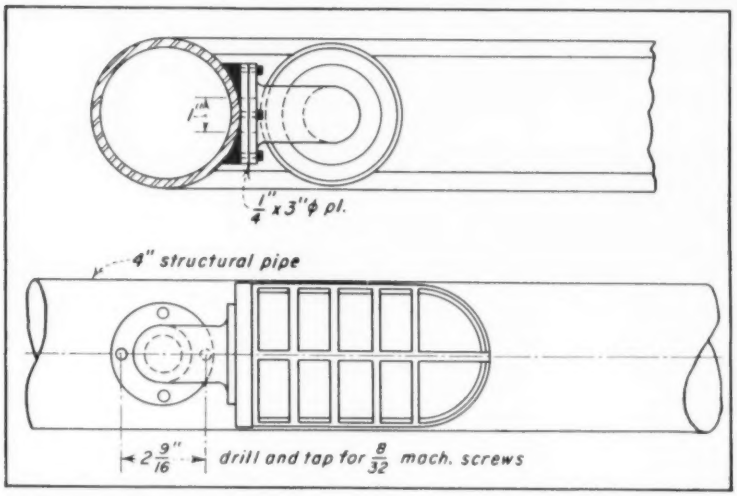


HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

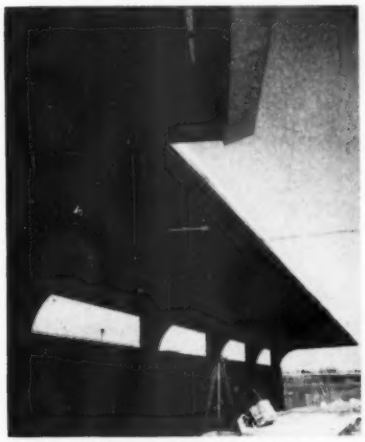
Distributed by GRAYBAR


...AND, YOU KNOW JIM, OUR RELATIONSHIP WITH SOME OF THESE MANUFACTURERS DATES BACK 50 TO 60 YEARS.
I'M BEGINNING TO TO SEE WHAT CHARLIE MEANS ABOUT GRAYBAR SERVICE... LET'S SIT DOWN AND DISCUSS THAT NEW CELCO JOB.
WAREHOUSE
GraybaR ELECTRIC COMPANY
LATER...
HELLO BARNES, HI JIM -- I CAN GUESS FROM YOUR GRIN THAT THIS JOB'S GOING SMOOTHLY.
I'LL SAY! THANKS FOR PUTTING ME WISE!
NEW HOME OF CELCO M
ELECTRICAL WORK by JAMES BR
GraybaR ELECTRIC COMPANY
IN ADDITION TO SEEING THAT I GET STUFF "ON-SCHEDULE", BARNES HERE HAS ALREADY HELPED ME SOLVE A COUPLE OF TOUGH PROBLEMS BY CALLING IN A GRAYBAR SPECIALIST.
TAKE THAT LIGHTING INSTALLATION, FOR INSTANCE... THEY CAME UP WITH COMPLETE LAYOUT AND ENGINEERING DATA.
AS FOR THE DISTRIBUTION SYSTEM...
HEY, WAIT A MINUTE -- I REALIZE BARNES KNOWS HIS STUFF, BUT YOU'RE SOUNDING LIKE A REAL GRAYBAR BOOSTER.
THAT'S RIGHT, CHARLIE! I'VE LEARNED FIRST HAND HOW IMPORTANT ONE SOURCE AND ONE RESPONSIBILITY CAN BE IN GETTING FAST, EFFICIENT SERVICE ON MATERIALS FOR ANY WIRING, LIGHTING, VENTILATING, COMMUNICATION OR POWER NEED. FROM HERE ON, I'M MAKING IT MY BUSINESS TO CALL GRAYBAR FIRST FOR EVERYTHING ELECTRICAL.
330-44
CALL GRAYBAR FIRST FOR...
GraybaR Everything Electrical GraybaR ELECTRIC COMPANY
IN OVER 100 PRINCIPAL CITIES

Practical Methods



ROUND DISCS are welded to the inboard side of the pipe, drilled to accommodate the branch wires, and drilled and tapped for fixture-supporting machine screws.



HALF SHADE LIGHTING UNITS are positioned along the forward edge of Lincoln Electric's entrance platform, supported by structural pipe which also serves as the lighting wireway.

Structural Pipe Used As Lighting Wireway

WIRING

Structural pipe serves a dual purpose at Lincoln Electric's vast new $8\frac{1}{2}$-million plant in Euclid, Ohio, where it is used as a framing member for the cantilever canopy over the entrance platform and as a raceway to carry circuits for the platform lighting system.

The pipe is 4-inch diameter stock, secured to specially-fabricated cantilever beams extending from the rear of the sheltered concourse. At regular intervals along this pipe line, 1-inch holes are drilled on the inboard surface. Around the holes, $\frac{1}{4}$-by-3-inch discs are welded, and discs are drilled and tapped to accommodate standard machine screws. These screws support half-shade incandescent lighting units. Wiring is carried from lamp sockets through the pipe line to the control board located inside the main entrance.

A substantial economy was effected as a result of this special framing-and-wire-way assembly.

Truck-Mounted Crane and Ladder Speed Erection of Standards

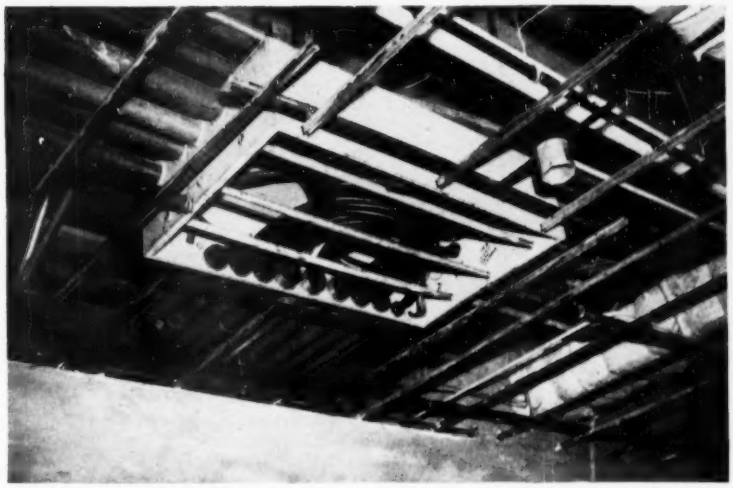
HIGHWAY LIGHTING

To light the approaches to Philadelphia's new 4-lane Penrose Avenue Bridge spanning the lower Schuylkill River, electrical contractor W. V. Pangborne of that city erected 622 aluminum lighting standards along 10 miles of streets and highways. Spaced 200 feet apart on both sides of the roadways, and staggered for more even light distribution, the standards were erected by small crews of men working from relatively small trucks.

With one truck fitted with a Garland crane, poles were easily positioned and bolted to pre-set pedestals. With a second truck equipped with a telescopic extension ladder, luminaires were rapidly installed after poles had been secured.

Lightweight trucks were possible because of the lightness of the standards, and workmen commented on the ease and speed with which standards were erected with the aid of the truck-mounted equipment. The use of small trucks had the added advantage of leaving streets unobstructed to normal traffic, for trucks could park closely parallel to curbs during the installation period.

In addition to lightness of weight



FEEDER PULL BOX NESTLES in suspended ceiling framework at the new California Motor Vehicle Headquarters building in Sacramento. C. A. Langlais Company, project electrical contractor, rod-suspended the 5-ft. by 2-ft. by 6-in. steel box from concrete slab; added three $\frac{3}{4}$-in. rigid conduit "rods" to support sweep of 250MCM and 500MCM cables entering and leaving the box. Nine conduits ranging from 3-inch on-down carry 440-volt feeders from penthouse transformer location to power load centers. Pull box will have a ceiling access panel.

Insulating News

News of G-E electrical insulating developments that can be important to your business.

FOR HIGH OIL RESISTANCE IN A BLACK BAKING VARNISH, USE G-E 9470

A High-Gloss Varnish That Also Offers Top Protection against Heat, Moisture, and Dirt

G-E 9470 is an asphaltic-drying, oil-type, electrical, insulating black-baking varnish. It is designed for treating electric apparatus and parts where flexibility is required—as well as resistance to heat, oil, dirt and moisture.

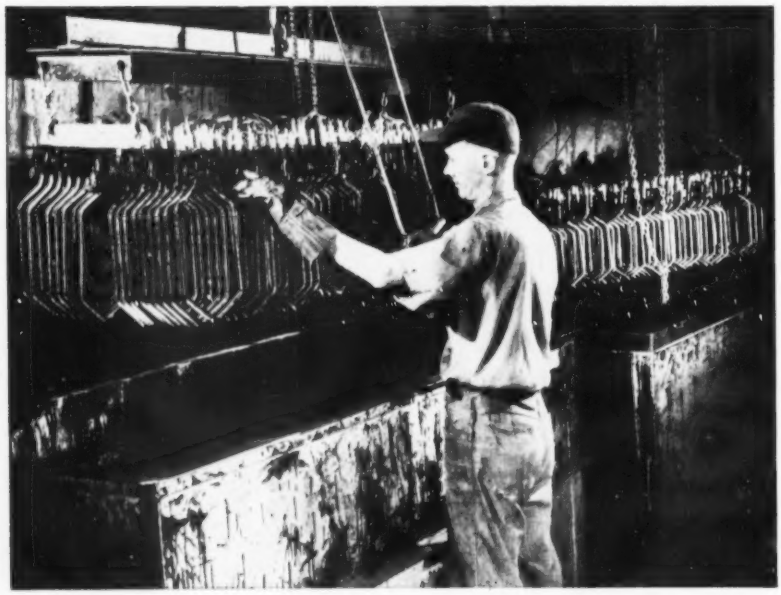
G-E 9470 bakes to a hard, glossy finish, and is excellent for:

Impregnating and Coating Fabric—wherever you use cotton, rayon, orlon, glass, or other materials for wrapping field and sister coils.

Treating Coils—to protect armature and field coils from physical, chemical, or electrical damage.

Treating Assembled Units—such as completely assembled armatures or fields, for protection against operating hazards.

General Electrical Protection—wherever you have electric equipment exposed to heat, oil, moisture, and other harmful elements.



For further information about G-E 9470, write: General Electric Company, Section 328-2B, Chemical Division, Pittsfield, Mass.

You can put your confidence in—

GENERAL ELECTRIC



CRANE MOUNTED on truck of electrical contractor W. V. Pangborne is used to position aluminum lighting standards above pre-set pedestals. Parked close to curb, truck leaves roadway unobstructed for normal traffic continuation.



TELESCOPIC LADDER permits electrical worker to rapidly and conveniently secure luminaire to arm of standard. Installation required only small crews and these men commented on the ease and speed resulting from using lightweight equipment and products.

and the resultant ease of handling, the use of aluminum poles also offered the advantages of long anticipated life, minimum maintenance and the elimination of necessary painting. This was considered especially important as protection against rust forming in the inaccessible interiors of the poles. The poles, fabricated by Pfaff and Kendall of Newark, N. J., are constructed of Alcoa aluminum.

Rolling Scaffold Adjusts to Man's Height

EQUIPMENT

Mechanics who comprised the fixture installation crew for the Charles A. Langlais Company, project electrical contractor, at California's new

Skylike SOLVES A LIGHTING PROBLEM

at the

SHERATON-CADILLAC



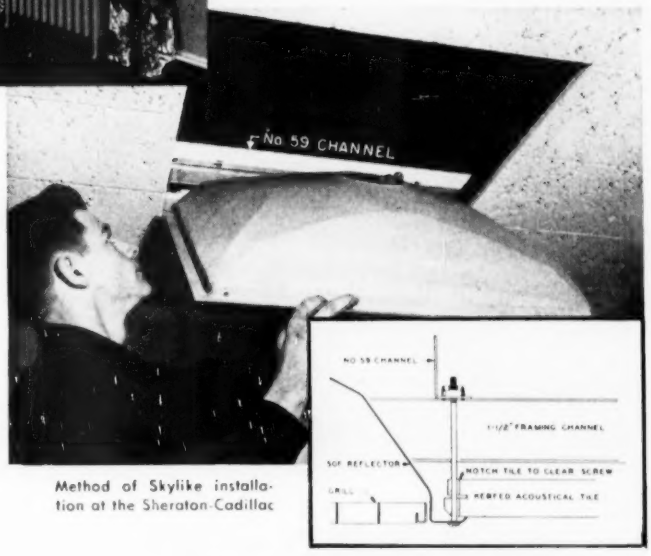
Bedroom suite at the Sheraton-Cadillac using Skylike units

THE PROBLEM . . .

Major renovations of this famous hotel involved air conditioning for the guest rooms. To complete the modernization acoustical ceilings were installed. Hotel management wanted recessed lighting units which would harmonize with any decorative scheme and provide comfortable well diffused illumination.

THE SOLUTION . . .

Recessed SKYLIKE incandescent units using 200W lamps were chosen and installed in the new hung ceiling construction. Sheraton-Cadillac engineers developed a special mounting device for the reflectors which would allow them to be supported from the ceiling framing members without need of bolts or other fastening devices. This permitted adjustment and alignment of fixtures after acoustical panels were installed. (See insert)



Method of Skylike installation at the Sheraton-Cadillac

Skylike ...

This modern, versatile unit can solve your lighting problems as successfully as it has in countless installations throughout the country in . . .

DEPARTMENT STORES
OFFICE BUILDINGS
HOUSING DEVELOPMENTS
SCHOOLS, ETC.
RETAIL STORES
THEATRES
BANKS

SKYLIKE
A SILVRAY-ASSOCIATED COMPANY

SEND FOR COMPLETE DETAILS

A comprehensive 8-page booklet describing the SKYLIKE system and its simple installation is yours for the asking. To get your free copy, fill in and mail the coupon below.

SILVRAY Lighting, Inc., 101 West Main St., Bound Brook, N. J.
Gentlemen:

Please send me complete information on Silvray **SKYLIKE**

Name_____
Firm_____ Title_____
Address_____
City_____ Zone_____ State_____



Develop an "X-ray" eye—

"AMPROBE" IT!

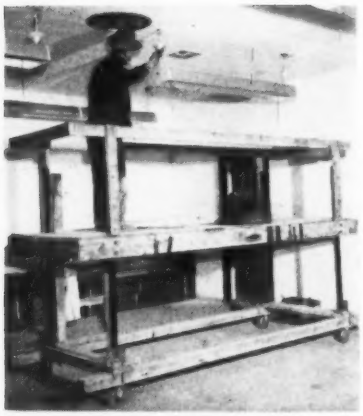


Now you can diagnose trouble calls at a glance, without shutting down equipment or making ammeter connections. Just snap the Amprobe around one conductor (insulated or uninsulated) and you have an accurate current reading. Walk in with this pocket-size snap-around volt-ammeter, and "you're the doctor." Write for Catalog.

Dept. ECM 43, Pyramid Instrument Corp., Lynbrook, N. Y.

(Export Div.: 458 Broadway, N. Y. 13.)

Amprobe "300" 0-6/15/30/60/150/300 amps A-C. 0-150/300/600 volts A-C. Complete with cowhide case and voltage test leads: $49.50. Amprobe "600" (to 600 amps A-C) $59.50 complete. Amprobe "1200" (to 1200 amps A-C) $67.50 complete.



VERTICAL ADJUSTMENT, inch-by-inch, or fractions if necessary, is feature of this rolling scaffold. Working platform and guard rail can be raised or lowered, on steel upright channels, to fit mechanic's height.

Motor Vehicle Department Headquarters building in Sacramento, worked in the most comfortable position possible. They did not have to reach on tip-toe, nor crouch to carry out their installation assignments. Reason: they were working on a scaffold that could be adjusted, by inches if necessary, to fit their height.

This handy rolling scaffold was designed and built through the collaboration of Langlais' branch manager Edward Robinson and general foreman Charles Svec. The unit is 10-ft. long, 4-ft. wide and has a working platform 52 inches above the floor (level shown in photo for ceiling height and height of workman). A sturdy guard rail around the platform protects the workman and also can be used as a support for an assembly surface when a plank-table is added. Both the platform and guard rail can be raised or lowered to fit the requirements of the mechanic. The scaffold rolls on four 5-inch diameter industrial casters.

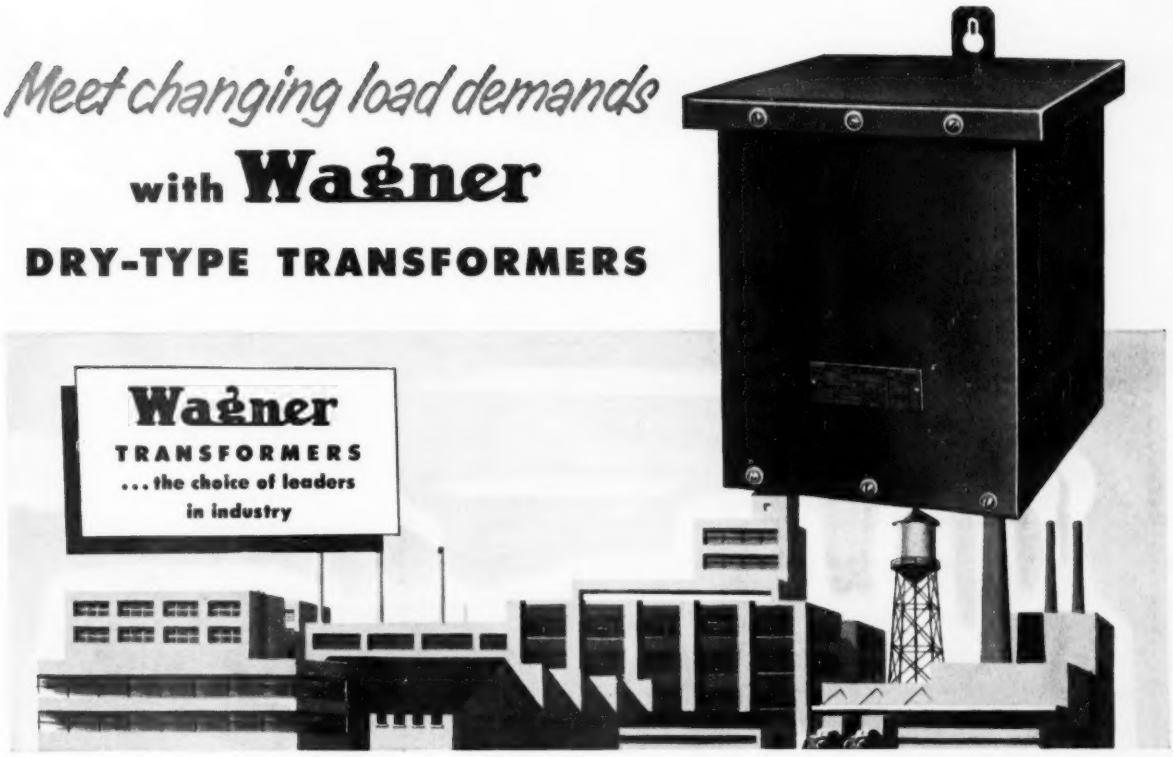
Heart of the adjustable feature is the use of four Unistrut uprights. These are mounted to right angle steel plates bolted to the 2 by 8 plank cross-pieces on 4 by 4 base frame. Frame for the plywood working platform consists of 2 by 6 sides with 2 by 4 cross-bracing.

Double bolts through the 2 by 8 sides of the frame secure the platform at each Unistrut upright (total of 8 bolts for the platform). The 2 by 4 guard rail (same size as the platform) has four supporting "legs" of the same material. Each leg is fastened to the steel upright by two bolts. Since the guard rail and platform are independent of each other, each can be raised or lowered to any position along the upright channels by merely loosening and tightening supporting bolts. The serrated feature of the

Meet changing load demands

with Wagner

DRY-TYPE TRANSFORMERS



Wagner dry-type transformers can solve your problems by putting the right voltage close to the load wherever machines, portable tools or lights require voltage changes.

SAFE- Wagner dry-type transformers meet all requirements for indoor installation. They will save you money on insurance premiums. Fireproof vaults or other special protection are unnecessary—even where fire hazards are present.

ECONOMICAL- When you use Wagner dry-type transformers, you reduce installation costs—you reduce line losses—you eliminate long runs of secondary copper—and you can forget about maintenance.

COMPACT- Wagner dry-type transformers are small in size—light in weight—easy to install and easy to move whenever changes in plant facilities make it necessary.



Form W

Core and Coil

These transformers are built in the Wagner Form W design with cores of cold rolled oriented grain transformer steel which permits less weight per kva and small size cases for space-saving installation.

80° C Rise — Class B Insulation

Safe operation is assured through the use of class B inorganic insulation throughout the coil structure. Liberal ventilating ducts provide high short time overload capability. Available in sizes 3.0 to 100 kva, 600 volts and below.

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6413 Plymouth Ave., St. Louis 14, Mo., U.S.A.

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ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

BRANCHES IN 32 PRINCIPAL CITIES

T53-7

TRY TRADE ARRO MARK

MASONRY ANCHORING DEVICES

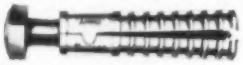
for maximum holding power



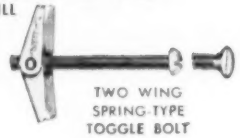
Arro anchoring devices are designed to give you **MAXIMUM HOLDING POWER** . . . year in and year out. When you think of anchors, think of Arro!



ARROFLUTE CARBIDE MASONRY DRILL



LAG SCREW EXPANSION SHIELD



TWO WING SPRING-TYPE TOGGLE BOLT



A-C-E EXPANSION SHIELD



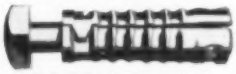
SPRING HEAD STEEL TOGGLE BOLT



DOUBLE EXPANSION SHIELD



RIVETED HEAD TOGGLE BOLT



O-E EXPANSION SHIELD



LITTLE MAJOR TURNBUCKLE



MACHINE SCREW ANCHOR



FOUR-POINT HAND STAR DRILL



STUD BOLT ANCHOR



THREE-POINT DRILL POINT



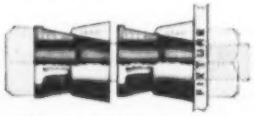
LEAD SCREW ANCHOR



FOUR-POINT DRILL POINT



TWIST DRILL POINT



MAL-LEAD BOLT ANCHOR



RUBBERGRIP DRILL POINT HOLDER

See your industrial, hardware or electrical supplier

ARRO EXPANSION BOLT COMPANY

1540 Boone Ave., Marion, Ohio

clamping nut in the channel prevents slippage when the bolt is tightened and assures a sturdy working platform.

When continuous rows of end-to-end or troffer type fixtures are installed, two or more scaffolds can be placed end-to-end to increase the effective length of the adjustable working platform.

Langlais' management finds this type of scaffold a commendable addition to the long list of job tools. Net result: better and more efficient workmanship with less fatigued mechanics at the end of the day.



OUTDOOR LADDER RACK with roof protection solves a storage problem at the Oakland, California, headquarters of the T. L. Rosenberg Company. Extension and A-ladders are hung on supports consisting of channel iron uprights (bolted to building wall) with welded conduit "arms" while step ladders are stacked in upright positions at opposite end of lean-to. Outdoor storage scheme releases valuable indoor space and speeds loading and unloading of ladders on trucks.



HEAVY-DUTY REEL TRAILER increases mobility of wire pulling crews on electrical construction jobs of Ets-Hokin & Galvan, prominent San Francisco electrical contractors. Enthusiastic about the unit are Al Eddy, manager, and Fred Byrum, chief estimator at the San Diego branch where the equipment was built. The trailer moves on standard automobile wheels with low pressure tires and holds a total of 15 reels on five sets of reel supports (three reels at rear not shown). Telescopic design of support permits vertical adjustment with pin lock so reels can be elevated in steps.

BIDDLE
Instrument News

- ELECTRICAL TESTING INSTRUMENTS
- SPEED MEASURING INSTRUMENTS
- LABORATORY & SCIENTIFIC EQUIPMENT

JAMES G. BIDDLE CO., 1316 ARCH ST., PHILADELPHIA 7, PA.



Photo Courtesy Copperweld Co.

ARE YOU SURE OF PROTECTION THROUGH YOUR GROUND CONNECTIONS?

MEGGER® Ground Tester measures low resistance

In spite of apparently good lightning rod or arrester protection, lightning frequently will cause severe damage if high ground resistance hampers its dissipation in the earth. Lightning storms are prevalent in the northeastern states during the spring and fall months. Plants in this section should make a thorough round of ground resistance tests. Aside from the hazards to personnel, thousands of dollars may be saved in damage to electrical equipment and in loss of power and stoppage of production.

The MEGGER® Ground Tester is the easiest, quickest and most accurate method of determining ground resistance. It is an instrument specially designed for the purpose and should be used wherever possible. Direct readings are automatically obtained in ohms. It provides its own source of current—no batteries, or other remote source required. It's easy to carry, too. Has approval of the Associated Factory Mutual Insurance Companies.

Don't put it off—write today for "Grounding Electrical Circuits Effectively" by J. R. Eaton **(Bulletin 25T2-ECM)** and our Biddle manual on "Ground Resistance Testing" **(Bulletin 25J-ECM).**

Tips on TESTING...



...ELECTRICAL INSULATION RESISTANCE

Reconditioning Wet Apparatus

The bad effects of excessive moisture in insulating material, particularly when localized, are numerous. The effect most likely to result in failure in the early stages of exposure is that of low resistance paths which may develop either through or over the surface of the insulation. The likelihood of failure from this cause is increased by the presence of dirt and other foreign matter, and may occur in either organic or inorganic insulating material.

If moisture has been deposited on clean insulation only superficially, then the heat resulting from the normal operating temperature of the equipment may remove it before failure occurs. However, the normal operating heat of at least some parts of the equipment is sometimes insufficient to drive out moisture that has penetrated through surface defects.

If moisture is allowed to remain in insulation, it usually—in time—causes corrosion of metal conducting parts, aggravated by the presence of chemicals and electric potential, thus increasing the danger of failure.

In addition to apparatus which may be exposed to moist atmosphere, or wet with fresh water, there may be occasions when it becomes necessary to rehabilitate equipment that has been subjected to salt water. In such case, clean fresh water must be used to remove all traces of salt before drying of the apparatus is attempted. Any evidence of oil or grease on the insulation should also be removed by using a volatile solvent such as carbon tetrachloride.

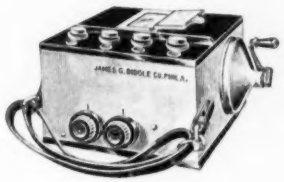
Then the apparatus must be dried out before electrical potential is applied. Numerous methods and various temperatures for drying out electrical equipment are used, including forced hot air, ovens, circulating electric current through the conductors, or combinations of these methods. Local conditions and facilities, manufacturer's recommendations, and the type of equipment involved, dictate the method used.

Test Procedure

If possible, secure records of previous insulation resistance tests on the apparatus.

Make short-time tests and time-resistance tests for comparison to help decide whether drying is necessary. If present readings are at all comparable with previous tests made at or corrected to the same temperature, a drying-out run *may* not be necessary.

NOTE: *The above material is taken from our Instruction Manual—for the use of Megger Insulation Testers. Within its 96 pages, such subjects as "Temperature Correction", "Interpretation" and many others are discussed in a clear and interesting manner with very ample illustrations, charts and tables. We'll be glad to send you a copy of this manual without obligation. Just write on your company letterhead for* ***Manual 21-J-ECM.***



INSULATION TESTER & WHEATSTONE BRIDGE in ONE EASILY PORTABLE INSTRUMENT

Measures Electrical Resistances From a Fraction of an Ohm up to 1000 Megohms

Affords the facility of:

- **A Wheatstone Bridge** for measuring conductor resistance of coils, resistors and circuits.
- **A Megger Direct Reading Ohmmeter** for measuring electrical insulation resistance (ohm and megohm scales).
- **A Varley Loop Feature** for locating faults on wires (optional).

This Bridge-Meg weighs only 15 lbs. and is completely self-contained with its own constant-voltage generator—no need to be dependent on batteries or other suitable test current.

Why burden yourself with two instruments when you can have the facilities of two for little more than the price of one in one compact, sturdy case. For complete details and prices write for **Bulletin 21-60-ECM.**

JAMES G. BIDDLE CO.

- ELECTRICAL TESTING INSTRUMENTS
- SPEED MEASURING INSTRUMENTS
- LABORATORY & SCIENTIFIC EQUIPMENT

1316 ARCH STREET
PHILADELPHIA 7, PA.



G-E METAL-CLAD SWITCHGEAR lineup is shown during installation in power house at Ford's Lincoln-Mercury plant, Wayne, Mich. Interrupting capacity of magne-blast breakers—totally enclosed bus compartments protect against power shutdowns.

G-E metal-clad switchgear protects power system in huge new Lincoln-Mercury plant

Secondary selective system with packaged units installed at new 35-acre auto plant

Mass production of 1953 Lincoln automobiles—rolling off assembly lines of the new Lincoln-Mercury plant at Wayne, Mich.—depends on the power distribution system behind the machines.

Ford has installed standardized G-E switchgear and nine double-ended load centers to provide safer, more reliable, *protected* power throughout the 1,500,000 square-foot plant, all under one roof.

The compact metal-clad lineup of eight feeder and two incoming line compartments in the power house takes primary voltage at 13.2-kv, purchased by Ford from Detroit-Edison. A bus tie-breaker compartment, with latest metal-clad design improvements, can isolate transformers if failure occurs—gives added reliability by feeding all units in the plant's secondary selective system.

Near switchgear line-up, two double-ended load centers, rated at 1,500-kva each, take care of power house auxiliaries. Seven 2,000-kva double-ended load centers are installed in bays in outer wall of plant building as near to loads as possible. These feed the main factory area.

G-E engineered, factory-assembled switchgear and related equipment can help you in plans for efficient, flexible, *dependable* power distribution systems. Call your local G-E Apparatus Sales Office—or write to General Electric Co., Schenectady 5, New York. 874-2



TIE-BREAKER GIVES dependable power in secondary selective system throughout Lincoln-Mercury plant. Bus tie-breaker in switchgear section contains new elevating mechanism.



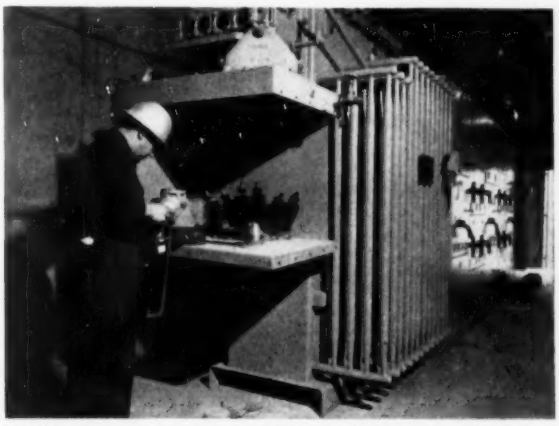
PLANT ENGINEERS inspect load center unit substation in power house, shown here immediately after energizing. This is one of nine new units installed in plant.



INCOMING BUS at rear of compact, factory-engineered switchgear compartment is wired and wrapped. Rigid doors and frame of G-E metal-clad give added safety.



SMALL BAYS along outer walls of 35-acre plant each contain double-ended load-center substations, place them near assembly-line operations on main plant floor.

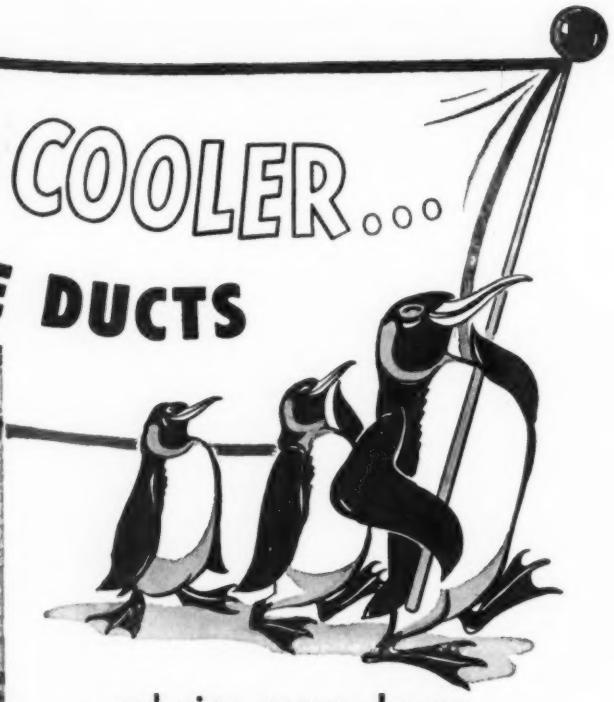


POWER FEEDS factory area through double-ended 2,000-kva load centers. Transformer's high side is being connected here with cable from pothead to oil switch on platform.

GENERAL ELECTRIC

Cables run COOLER...
in TRANSITE DUCTS





... reducing copper losses
... increasing current capacity
... prolonging insulation life

YOU REDUCE copper losses . . . increase current carrying capacity . . . and prolong insulation life, when you run your cables in Transite* Ducts.

Current carrying capacities can be increased in a typical duct bank as much as 5%, or I^2R losses can be reduced 11%, for cables located in Transite as compared with other ducts used for power circuits.

And, Transite Ducts assure permanent duct banks because Transite is incombustible; is immune to rust and rot; is unaffected by electrolysis; will not slag under action of an arc, and will retain its high original strength.

An unusually smooth bore assures no injury to cable sheath, either in natural movement under load, or when pulling-in cables. Long, lightweight lengths can be quickly and economically installed. In addition, a full line of fittings simplifies even the most complicated of installations.

For full information on Transite Ducts, write for Data Book DS-410. Johns-Manville, Box 60, New York 16, N. Y.

JM

*Reg. U. S. Pat. Off.

How Transite Ducts increase current carrying capacities

Type cable 3 cdr. 500 MCM Compack Sector, 15 KV (6th Edition AEIC Spec.)
No. of cables—3 (all loaded in one bank)
Daily Load Factor—75%
Earth Temp. ambient—20 C.

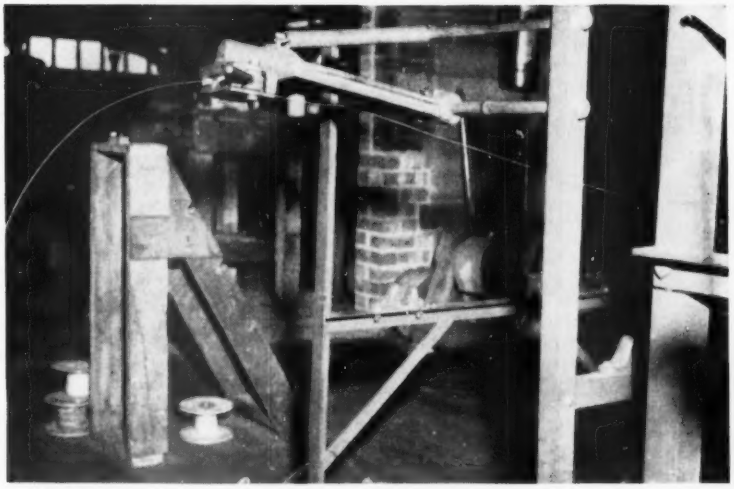
	Transite	Other
Total Therm. Res. to Dielectric Loss (C watts/ft.)	5.66	6.17
Total Therm. Res. to Copper Loss (C watts/ft.)	4.44	4.95
Temp. Rise from Dielectric loss (C)	1.9	2.1
Allowable Rise for Copper loss (C)	59.1	58.9
Allowable Watts per ft cable	4.44	3.96
Allowable Current—(Amps. per cdr.)	386.	365.
Allowable Current—(Relative %)	105.6	100.

Johns-Manville *Transite Ducts*

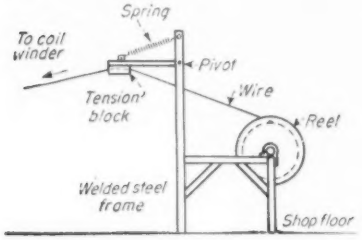
TRANSITE KORDUCT— for installation in concrete

TRANSITE CONDUIT— for exposed work and installation underground without a concrete encasement

Motor Shops



TENSION DEVICE is supported by arm which is pivoted to horizontal shaft held by welded steel frame members. Coiled spring runs from this arm to a point above the arm's pivot point.



COILED SPRINGS prevent tension from being applied to the wire suddenly, thereby equalizing the strain on the wire and resulting in constant counter force at the winding position.

Spring Equalizes Tension On Wire

Frequently, when a coil winding machine starts up suddenly, a tension block builds up a peak of resistance that can jerk the cable with considerable force, resulting in an unevenly wound coil. Not so, however, when the winder comes up to speed in the shop of the Warwood Armature Repair Company of Wheeling, W. Va., for the tension block is backed by a coiled spring which equalizes this counter force and prevents sudden strains from developing.

Simple in construction, the spring is mounted in the center of the arbor which supports the pivoted tension block. Under normal operation the weight of the block and resistance of the coiled spring holds the tension device in a fixed position. However, when tension builds up during starting periods, the spring is slightly stressed and elongates temporarily. The result is an equalization of strain and a gradual increase and decrease rather than a sudden application of force. The frame also supports the wire reels on horizontal shafts so the weight of the wire tends to stabilize the frame. Construction is welded.

Burn-out Booth Has Turntable Stator Stand

Incineration is used to speed stator and armature stripping in the motor repair shop of the Wm. C. Krauth Electric Co., Louisville, Kentucky. Burning the insulation serves a dual purpose. It facilitates coil removal from the slots and leaves bare copper —a form that commands a better price in the scrap market.

The operation is carried out in a metal burn-out booth—an enclosure 46 inches wide, 35 inches deep and 7½ feet high. A metal grate about 29 inches from floor level forms the base. On this is mounted a circular heavy steel plate grooved in the center to seat an MRC 217M ball bearing (5¾-in. diameter). A gas pipe extension centers under the bearing and base plate.

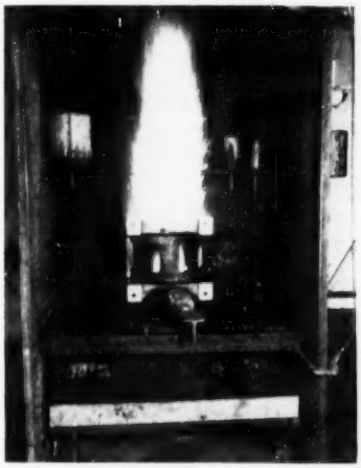
A removable, crow-foot type stator stand rotates on the bearing. This Y-shaped stand is constructed of 18-inch sections of 4-in. by 1¾-in. angle-iron bolted back-to-back and welded to a supporting sleeve at 120-degree spacing. When the crow-foot is in place, the bearing is completely enclosed and no dirt or ashes can get in. The rotating feature of the stator stand makes it easier for the mechanic to remove the incinerated coils while the stator is still hot. Normally, long hand-tongs are used to remove the copper. The mechanic grips a set of coils with the tongs and uses the opposite side of the stator as a fulcrum for leverage to dislodge the copper. Coils are then placed in a receiving tray directly under the grate.

Can-shaped gas burners, made of 26-gauge sheet metal perforated by numerous small holes, are used on stators. Length and diameter depend upon the size of stator on the stand.

Four burners, of the following di-



STATOR WINDING is cut on one side before unit goes into burn-out booth. Hammer and chisel is more effective than air-chisel on spongy coil insulation.



ON THE FIRE. Stator coils are ignited by gas flame and burn under natural draft until insulation turns to ash.

Now you can choose

BERNS
AIR-KING
Ventilating Fans

for every purpose
—in any size
and price range



wall switch controlled

low cost model AUTOMATIC SIDEWALL

Now available at the same price as pull chain models! Weatherproof outside hood protects against ice, snow, wind and rain—encloses scientifically counter-balanced, exclusive "Flutter-Free" shutter that automatically opens and closes when fan starts and stops. **Wall Switch controlled**—single or three speed (extra). Unscrewing of center grill knob removes grill for easy cleaning. Motor and blade completely removable by merely loosening two wing nuts. In 8-inch and 10-inch models for walls 4½" to 28" thick. Sparkling white or chrome finish. **Full 5 year guarantee.** WF8C, WF10 and WF10C...priced as low as **$27.55**



CF10N
CF10NC

FOR CEILING OR SIDEWALL



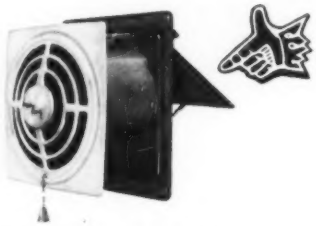
CF8C,

- **Only 3½" deep over-all**
- **Blower-type blade**

Most attractive, powerful, versatile kitchen fan available. New blower-type pressure blade maintains high air exhaust volume in long ducts. Mounts in ceiling or sidewall. Grill removes by merely unscrewing center grill knob. Outside frame will never warp or rust. Model CF8C especially recommended where low cost is a deciding factor. In White Enamel or Chrome finish. Available with 3-Speed Control switch (extra). **Full 5 year guarantee.** CF8C, CF10N and CF10NC...priced as low as **$27.95** complete with Wall Cap.

ECONOMICAL PULL CHAIN MODELS

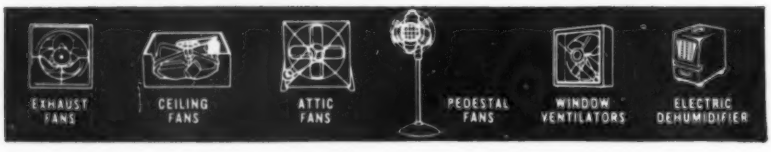
Where wall switch is not desired, this powerful, economical pull chain model is highly efficient. Eliminates wall switch installation cost. Outer frame will never rust or warp fan housing. Grill easily removed by merely unscrewing center knob. Motor mounted on one bracket—motor and blade completely removable by loosening just two wing nuts. Available in 8" and 10" models, white enamel or chrome finish for walls 5½" to 16" thick. **Full 5 year guarantee.** KF8N and KF10N ...priced as low as **$27.55**



Listed in Sweet's Catalog or ask your Wholesaler.

Complete catalog available by writing to

BERNS MFG. CORP. 3050 N. ROCKWELL ST., CHICAGO 18, ILL.





COILS ARE REMOVED with hand tongs while copper and stator are still hot. Copper is placed in tray under grate.



CAN-TYPE BURNERS have pipe nipples which extend through crow-foot stator stand and screw into gas pipe.



BASE PLATE BEARING on which crow-foot stator stand rotates. Groove in plate and sleeve of stand protect bearing from dirt and insulation ash.

mensions, comprise the set for this booth:

Diameter	Height
2¼-in.	6¾-in.
3-in.	7-in.
5-in.	9-in.
8-in.	10-in.

All burners have a ¾-in. pipe nipple which extends through the stand and is screwed into the gas pipe extension under the base plate.

A T-type burner made of 1-inch pipe is used for burning out armature coils.

One side of the winding must be cut

You get ALL these Features when you buy PET Drills!



If you want the *best* for your maintenance or production work, take an extra look at the PET Superduty Drill shown here. Check its features! Here's a drill that's made for heavy, continuous duty...with *plus* power per pound . . . built to *work* right and *handle* right on the job.

Normally you might expect to pay extra for such features—in the form of "optionals" that jack up your cost. But that's not true of PET Drills! All these features are standard in the PET Superduty line . . . *and they're available to you at a standard drill price!* That's why the coupon below can save money for you. For free catalog and name of your nearest PET distributor, *mail it today!*

NOW...you can get the RIGHT DRILL for YOUR job!

PET Superduty Drills are available in 54 distinct models and 3 capacities: ¼", ⅜" and ½". Your choice of pistol or saw-type grip. With such a broad line, you don't have to compromise on a drill that's "almost" right! You can choose *exactly* the drill you need for your job. The PET Superduty line includes drills meeting U. S. Government and military specifications.

PET® POWER TOOLS

Plus Power per Pound

PORTABLE ELECTRIC TOOLS, INC.

320 West 83rd Street, Chicago 20, Illinois

In Canada: Portable Electric Tools, Ltd., 452 Birchmount Road, Toronto 13, Ontario, Canada

MAIL COUPON FOR FULL INFORMATION

PORTABLE ELECTRIC TOOLS, INC. EC-43
320 W. 83rd St., Chicago 20, Ill.

Gentlemen: Please send us free copy of your PET Superduty catalog, and name of nearest distributor.

*Name*_____ *Title*_____

*Company*_____

*Address*_____

*City*_____ *State*_____

FULLMAN **Latrobe**
Electrical Products

Floor Boxes and Wiring Specialties

ADJUSTABLE WATERTIGHT FLOOR BOXES
•
NON-ADJUSTABLE WATERTIGHT FLOOR BOXES
•
ADJUSTABLE GANG FLOOR BOXES 1-2-3 AND 4
•
FLOOR JUNCTION BOXES

FULLMAN MANUFACTURING CO. QUALITY AT LATROBE SUPREMACY LATROBE, PA.

All "Latrobe" Adjustable Watertight Floor Boxes are now equipped with a positive electrical bonding wire between the exposed flush parts and the conduit system, which make them completely fireproof.

Conforms to Underwriters' Laboratories specifications and complies with the National Electrical Code.



Adjustable Watertight Floor Box

Can be had in single, two gang, three gang and four gang Floor Boxes.



Receptacle Nozzle

We can supply a type nozzle to fit any application you might desire.

Write for complete catalog and price list

UTILITY OUTLETS
•
NOZZLES AND FLOOR BOX ACCESSORIES
•
INSULATOR SUPPORTS
•
PIPE AND CONDUIT HANGERS
•
ARMORED CABLE SUPPORTS
•
CABLE CLIPS
•
STAPLES
•
FISH WIRE

Fullman Manufacturing Co.
1209-1215 JEFFERSON STREET
LATROBE, PA.

before the stator is placed in the burnout booth. Krauth mechanics prefer the hammer and tool steel chisel for this operation. They find this more effective than the air-chisel particularly when spongy coil insulation is encountered.

Perforated Order Blank Speeds Motor Logging

When a motor is received in the shop of Walter J. Rider, Binghamton, N. Y., for repair, four record forms are prepared by checking a single order blank.

Order pads have alternate pages of white paper and manila cardboard, each two pages identically numbered, and a carbon pre-fixed beneath each white sheet. When a motor is logged in, the top of the white sheet becomes the office record, while the top of the cardboard (heavier for rougher handling) is retained in the shop control post for ready reference during the repair interval. Since a horizontal line of perforations make it easy to tear off the bottom of each sheet, the bottom of the white sheet serves as a handy claim check and is given to the person who delivered the motor to the shop. The bottom of the cardboard sheet is wired to the motor frame to serve as an identification as the motor proceeds to the stripping bench and repair areas.

The record lists the usual grouping of motor characteristics, but also provides space to indicate whether the order is to be cash, charge or COD;


Repair Order No. 26904

WALTER J. RIDER Co.

No. 26904

OFFICE AND SHOP RECORDS, identification tags and claim checks are made out by the receiving clerk who fills in a single order form. Perforations and pre-inserted carbons facilitate ready separation of tags from forms, and guarantee exact duplication of information.

whether an initial estimate was given; whether the repaired unit is to be delivered or called for, and similar information to insure accurate billing and satisfactory service.

The mechanics of logging-in motors has been simplified through the adoption of this handy system, time has been saved and the possibility of making an error while making out several separate sheets is eliminated.

Motor Stripping Aided By Lever Action

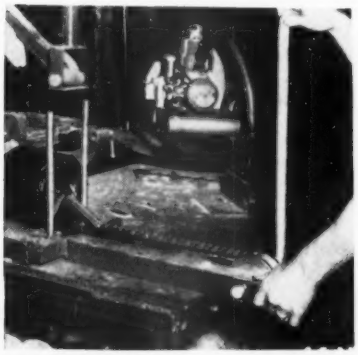
In the repair shop of H. N. Crowder Jr., Allentown, Pa., damaged coils are pulled easily and quickly by a practical, adjustable, table-top ripping unit.

Basically, the assembly consists of an 8-by-12-inch block with a series of holes drilled along the edge nearest to the operator. Steel pins may be inserted in these holes, and moved together or apart depending upon the size of the stator being handled at the time. To the front of this block, a 6-inch iron channel approximately 20 inches in length has been welded and, at the end overhanging the edge of the work table, a pulley and operating lever has been installed as shown.

To this pulley is fastened a section of chain, while a hook for ripping out the damaged coils is bolted securely to the chain end.

In operation the stator is placed on the drilled block, the holding pins are adjusted as shown, the hook inserted beneath one of the coil knuckles and the lever pulled downward. This winds the chain around the pulley groove and considerable power is transferred to the pulling hook.

Since the stator is held in place only by the vertical pins, rather than by any clamps or mechanical devices that have to be tightened, the unit can be rapidly revolved in its cradle as the coils are ripped loose.



STATOR IS HELD in position by steel pins as operator pulls lever downward, thereby wrapping chain around grooved pulley and exerting considerable pulling effort on hook, inserted beneath coil knuckles.

Make *your* pick-up truck a service truck



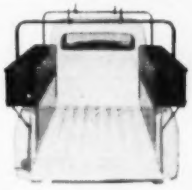
PAINTED...READY TO INSTALL

SERVICE-TWINS

TOOL AND MATERIAL COMPARTMENTS

It's easy to install Service-Twins. You need only a wrench and drill to do the job. No painting is required. Service-Twins are finished in baked-on synthetic enamel, that's rust and chip-resistant. Color is medium-dark green.

Built-in parts bins are standard equipment. Doors have slam-action catches with cylinder locks, keyed alike. Overhead rack with material brackets, shown at right, is optional.



Service-Twins are available in 74" and 84" lengths, for ½ and ¾ ton pick-up trucks.

SERVICE-TWINS are manufactured by the makers of the famous *Service-Master*

Service-Master . . . the all purpose service body designed to take a complete workshop to the job . . . the pace-setter in the service industry. In sizes for ½, ¾, 1, and 1½ ton chassis. Weatherproof doors are fitted with recessed, slam-action catches, and cylinder locks, keyed alike. Complete with built-in shelves and bins. Optionals include removable overhead rack, pipe rack, vise support, telescopic roof, and rear bumper-step.



McCABE-POWERS AUTO BODY COMPANY

5900 NO. BROADWAY • ST. LOUIS 15, MO.

Please send me complete details on Service-Twins ☐ Service-Master ☐

Name _____

Company _____

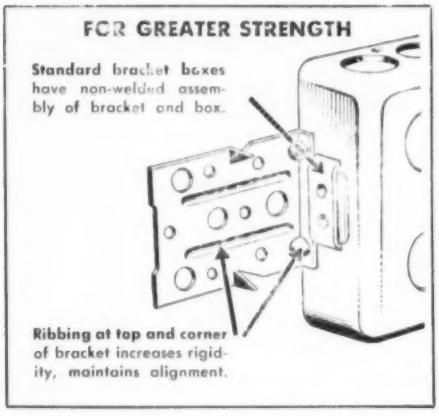
Address _____

City _____ Zone _____ State _____

EC



170 TYPES OF G-E BOXES AND COVERS



now available to meet your wiring requirements

With the recent addition of many new boxes, the G-E line of octagon, square, old-work, Levelock sectional device, and standard bracket boxes and covers now includes more than 170 types.

This complete line, including some boxes with and some boxes without cable clamps and plaster-mounting ears, makes it easy for you to select a box that exactly meets your wiring requirements.

It will pay you to investigate the complete line of G-E boxes and covers. Get full details from your G-E Construction Materials distributor, or write to Section C22-118, Construction Materials Division, General Electric Company, Bridgeport 2, Connecticut.

You can put your confidence in—

1878 75 1953 YEARS OF ELECTRICAL PROGRESS

GENERAL ELECTRIC

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For further information on new products, trade literature and advertising appearing in this issue—

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Item Number ☐☐☐☐☐☐☐☐

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Advertisement on Page ☐☐☐☐

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ELECTRICAL CONSTRUCTION AND MAINTENANCE—A McGraw-Hill Publication

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ADDRESS .....

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The Editor
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330 West 42nd St.,
New York 36, N. Y.

PLACE 2¢
STAMP
HERE

The Editor
ELECTRICAL CONSTRUCTION AND MAINTENANCE
330 West 42nd St.,
New York 36, N. Y.

NEW PRODUCTS CATALOGS, BULLETINS ADVERTISEMENTS

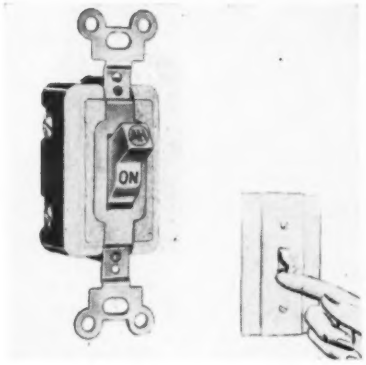
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Product News



Quiet Switch (1)

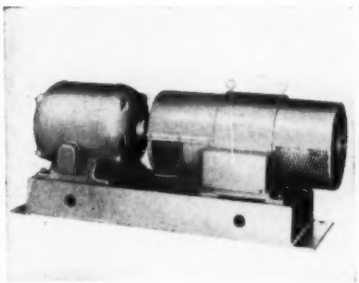
A new mechanical light switch known as the "Lifetime Quiette Switch". It can be installed in any position and it is for use with both incandescent and fluorescent lights. Other features include compact size, fully enclosed mechanism, heavy Bakelite body, and silver alloy contact tips. Switch offers optional back- or side-wiring with a handy Wire Strip Gage marked on the back plate. This is said to make possible faster, safer wiring on both old and new jobs. Switch is supplied with ivorylite or brown Bakelite operating handles, or lock type with key for institutional and commercial applications. Available for 15 amperes, 120 volts and 277 volts, ac only; and 20 amperes, 120 volts and 277 volts, ac only. For use in residences, institutions, industrial plants and commercial establishments. Typical examples cited are nurseries, bedrooms, studies, living and dining rooms in the home; churches, libraries, auditoriums, factories and convalescent homes; conference rooms, reception rooms, show and display rooms in business offices.

Arrow-Hart & Hegeman Electric Company, 103 Hawthorne St., Hartford 6, Conn.

Electrical Tape (2)

A new vinyl plastic electrical tape has been added to this line of insulating tapes. Called "Royalastic", it is a plastic film about 6 mils (0.006-in.) thick. One side has a pressure sensitive adhesive that makes the over-all thickness about 7 mils. The black tape has a tensile strength of 20 pounds per inch of width, abrasion resistance, and good adhesion at low temperature. It has dielectric strength of approximately 10,000 volts. Tape is not affected by sunlight, and it has no corrosive effect on electrical conductors. It has resistance to water, acids, alkalies, oils, and aging (room temperature). Tape is available in 66- or 30-foot rolls ¾-inch wide and in 10-foot rolls ½-inch wide.

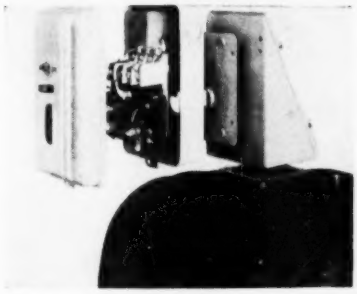
United States Rubber Company, Rockefeller Center, New York 20, N. Y.



Generators (3)

This line of continuous power generators has been expanded to include 20 different models ranging from one to 50 kw output. They are designed to provide an uninterrupted flow of regulated electrical power to microwave relay stations, telegraph and telephone carriers and other vital communications and signaling equipment. In addition, they can be utilized in hospitals, laboratories and other points where uninterrupted electrical power is required. Generator consists of an ac motor direct connected to an ac generator and a dc motor. Power to load is provided at all times by ac generator normally driven by ac motor which receives power from utility mains. When utility power fails, automatic control equipment disconnects the power line from the ac motor and connects the rotating dc motor to a stand-by battery bank. When line power is restored, ac motor is reconnected to line. Duration of operation on battery power depends upon capacity of battery bank. When power failures in excess of battery capacity are anticipated, an auxiliary engine-driven generator may be utilized to furnish ac to the ac motor or dc to the dc motor and battery bank. An automatic timer unit starts the engine generator after operation on battery.

Bogue Railway Equipment Division, Bogue Electric Manufacturing Co., Bogue Building, Paterson 3, N. J.



Starts and Contactors (4)

Motor mount starters and contactors for direct mounting on motors. Available in Furnas sizes YC, YD, and YE up to 10 hp starters and reversing starters. May be mounted on motors placed vertically, horizontally, or at any angle. These controls save labor and conduit between starter and motor. Available in sizes up to 10 hp at 220/440/550 volt polyphase in non-reversing, and in sizes up to 7½ hp at 220 volt, or 10 hp, 440/550 volt polyphase in reversing.

Furnas Electric Co., Batavia, Ill.

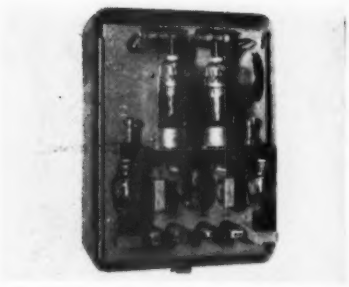


Roof Ventilator (5)

A heavy duty, high velocity roof ventilator for industrial construction, Type RVD and RVB. Weathertight, it is specially adapted for new windowless plant construction. Primarily used as an exhaust fan, it can be adapted for fresh air supply. Housing and hood are made of heavy gauge steel, undercoated with noise deadening material for quiet operation. Automatic built-in louvers act as back draft damper. If desired, louvers may be installed at base of unit. Hood can be removed for inspection. Fans available in direct and belt drive. Motors are ball bearing, totally enclosed or explosion-proof. Sizes 12-in. to 48-in., 1,300 to 20,000 CFM free air, 860 to 14,500 ⅛-in. static pressure.

Chelsea Fan & Blower Co., Inc., 639 South Avenue, Plainfield, N. J.

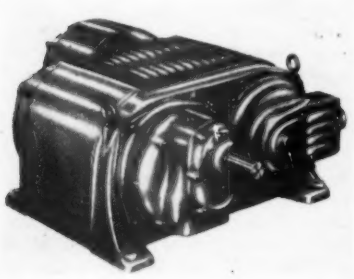

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MODERN
FITTINGS
Midwest Electric Mfg. Company
MANUFACTURERS OF ELECTRICAL WIRING PRODUCTS
1639 W. WALNUT STREET
Chicago 12, Illinois



Electronic Drives (6)

A simplified addition to this line of Thy-mo-trol packaged electronic adjustable-speed drives has been announced. Designed for use on many types of equipment, including testing machines, printing presses, conveyors, variable-volume or proportioning pumps, and machine tools, the unit is available for ¾ to 3 hp drives. It offers stepless speed-control, pre-set speed control, and close speed regulation, and includes small drive panel, measuring 15 by 18 by 12½ inches. Drive is offered in standard speed ranges of 5:1 and 20:1, and comes in both reversing and non-reversing forms. Motor will accelerate to and hold any pre-set speed within plus or minus 3% regardless of ordinary load changes. Simplified system consists of an anode transformer, electronic control panel, control station, and dc shunt-wound motor. It operates on 220/440 volts, single-phase 50/60 cycles. Dual rating of transformer makes it possible to use either voltage by changing primary connections.

General Electric Company, Schenectady, New York



Varidrive Motors (7)

Varidrive motors are now available in horizontal assembly up to 30 hp through the addition of a new horizontal frame size—64 VE. It possesses all the plus features of the upright 64 Varidrive including all-in-one construction (motor, variable speed transmission and gearing when necessary), microspeed control and indicator, splined Variodisc sheaves, double cog Varibelts with Autotaut tension control for permanent belt adjustment, dual belt construction, asbestos-protected motor and normalized castings. Also available in combination with Syncrogear with either single or double reduction gearing. Motor controls may be located above or at the side of motor. Remote controls are available either with mechanical extensions or electric pushbutton stations. Varidrive motors are offered in ratings from ¼ to 50 hp with speed variations up to 10:1. Speeds from 2 to 10,000 rpm.

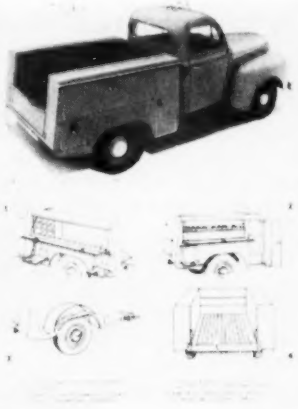
U. S. Electrical Motors, Inc., Box 2058, Terminal Annex, Los Angeles 54, Calif.



Lamp Assembly (8)

The new Levolier No. 4200 lamp assembly has a compact, streamlined housing with a single No. 41 switch for controlling both sockets. Sockets are heavy-duty, and can be swiveled 360° to provide flexibility in lighting. Housing is made of molded phenolic in brown or ivory. Wiring is simplified with two posts being fully exposed when cover is removed. Assembly is adaptable to both floor and table lamps.

McGill Manufacturing Co., Inc., Valparaiso, Ind.



Truck Body (9)

New features and improvements in the Service-Master body. These include: increased capacity of lower rear compartments; redesigned double-panel doors; rearrangement of parts bins and shelves, which are standard equipment; and a hinged cover over parts bins to provide additional shelf space. Exposed sections of all-steel body are sanded and sealed. Edges on doors, shelves, and bins are safety rolled to prevent cuts, and snagging of clothing. Compartment doors are fitted with recessed, slam-action catches and cylinder locks, keyed alike. Bodies are made to fit ½, ¾, 1, and 1½ ton chassis. Available in prime for shipment, or painted and installed on user's truck chassis. Optional equipment includes overhead rack with adjustable ladder, telescopic roof and end-gate enclosure.

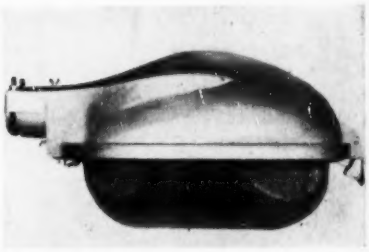
McCabe-Powers Auto Body Company, 5900 N. Broadway, St. Louis 15, Mo.



Receptacle (10)

A new 15 amp, 125 volt combination 3-2 wire grounding duplex receptacle. Designed to accommodate, at either end, both 3 wire tangential bladed grounding caps and conventional two wire parallel bladed caps. Adaptable to dc circuits because of its polarized parallel entrances, construction features of the 326 include a grounding terminal permanently connected to the mounting strap. Grounding terminal is marked and has a green hexagonal head screw to permit code identification of grounding wire. Other features include Channelock terminals which lock wires and prevent loose connections. Two terminal screws on both line and neutral sides of receptacle facilitate "through wiring". It has Underwriters approval.

Slater Electric & Mfg. Co., Inc., 56th St. and 37th Ave., Woodside, L. I., N. Y.



Street Lighting Luminaire (11)

An OV-20 street lighting luminaire designed to put more light on the street. A high co-efficient of utilization and hence relatively high average pavement illumination values are provided by this new model by compound reflector which directs light into two main beams at proper vertical angle, plus a special refractor for lateral control. Lateral distributions for different street widths are also available; ASA Type II distribution for narrow streets and ASA Type III for wider streets are available. A shield is available as an accessory for use on highways, areas adjacent to airports, and other places where glassware brightness may be objectionable.

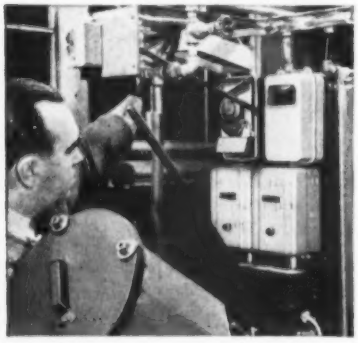
Westinghouse Electric Corp., Box 2099, Pittsburgh 30, Pa.



Save Time, Manhours, Power Costs, With G-E Time Switch Applications



SAVE MANPOWER, cut power consumption, reduce waste and spoilage—get more efficiency with a T-27 time switch.



EASY-TO-SET and install, the T-27 time switch handles almost any job—and does up to 10 on-off operations daily.

Uses for G-E time switches range throughout on-off jobs in farm, shop, and the home

Using time switches means that units can be off when not in use, or on prior to the time when the operator is ready to use the machine. Automatic control means savings in wear and tear on the unit, and in lowered cost for operating power.

YOU GET THESE BENEFITS

- Reduced manpower needs.
- Lower power consumption.
- Reduced waste, spoilage.
- Greater efficiency.

USE A G-E TIME SWITCH ON

Lighting control, heating and ventilating equipment, tumbling operations, chemical process control—remember, there's a G-E time switch for every on-off job.

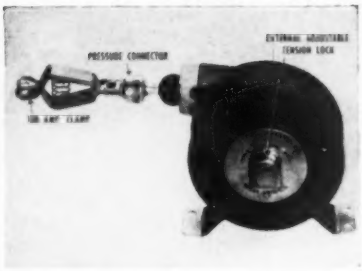
COMPLETELY AUTOMATIC

- Quick, easy installation.
- Easy-to-use feature.
- Negligible maintenance.
- Accuracy and dependability.

ORDER TODAY!

Contact your authorized G-E Agent or Distributor, or write for Bulletins GEC-535 and GEC-578, Section 603-157, General Electric Company, Schenectady 5, New York.

GENERAL ELECTRIC

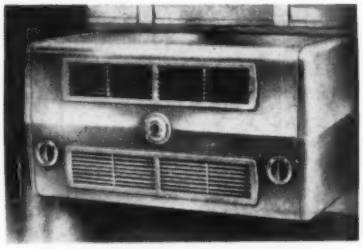


Static Discharge Reel (12)

An external adjustable tension lock which permits of increasing or decreasing tension of wind-up spring, has been added to this static discharge reel. Reel is grounded also through four electrical paths. A bridle to provide a second ground is available. A pressure connector automatically breaks contact as soon as force is applied, preventing damage should operator fail to release cable. Available in 40- or 80-foot lengths.

Ericson Manufacturing Co., 5209 Euclid Ave., Cleveland 3, Ohio

(13)



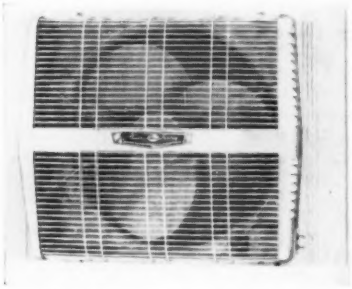
AIR CONDITIONING UNIT, Model G18A, one hp, especially suitable for extra large rooms at home, stores, and business and professional offices. It cools up to a capacity of 550 square feet and is available in either brown or ivory. Cabinet is made of steel, and is rust proofed. Plastic grills are used to eliminate moisture condensing on grill. Unit can be installed in any double hung window over 28¾ inches wide. All bracket accessories, including a Masonite panel, weather stripping, brackets and plated screws are supplied to permit installations in windows up to 48 inches wide. Overall dimensions are 28½ inches wide, 14¾ inches high, and 30¾ inches deep. It extends 14¾ inches into the room, and 16 inches outside window line. Available for either 230 volt, 60 cycles, or 230 volt, 50 cycles operation. Manufactured by Quiet Kool Division of the Quiet Heet Manufacturing Corp., 135 N. J. R. R. Ave., Newark, N. J.

Overload Indicator (14)

A new overload indicator for distribution transformers. Called type PL (performance log) indicator, the device utilizes a bimetallic thermostat embedded in transformer winding to give an indication of copper temperature. An excessive overload turns on a red signal light that

is visible from ground, and also registers overload on a dial. When coil temperature falls below danger point, red light goes out, but dial pointer remains in position to indicate that an overload has occurred. This sequence is repeated for five overloads, after which the dial continues to count overloads, but red light stays on to indicate potentially dangerous conditions and possibility of a burnout.

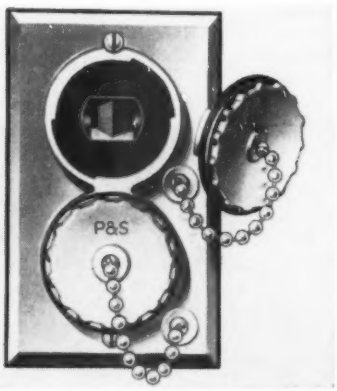
Westinghouse Electric Corp., P.O. Box 2099, Pittsburgh 30, Pa.



Ventilators (15)

Two new models of window ventilators, in a 16-inch and 20-inch size, both electrically reversible. Fans have been designed so as to occupy a minimum amount of space in depth. They are finished in ivory. Both fans offer two speeds for exhaust and intake. The 16-inch model is rated at 2000/1550 CFM, the 20-inch one at 3000/1950 CFM. A new 20-inch nonreversible exhaust model is also available.

Berns Mfg. Corp., 3050 N. Rockwell St., Chicago 18, Ill.



Weatherproof Outlet (16)

No. 4527 weatherproof duplex outlet which features a new type positive latching cap, has been redesigned. The new type cap has serrations for a firm grip, may be latched and unlatched, yet will not loosen. Double grip outlet is "13202" Despard type which meets Federal specifications. Plate and cap are cast of aluminum alloy, treated to withstand severe weather conditions. Cover and plate gaskets seal outlet against elements.

Pass & Seymour, Inc., Syracuse 9, N. Y.

Carries your shop to the job...

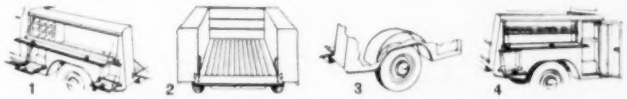


the NEW **Service-Master**

ELECTRICAL CONTRACTING SERVICE BODY

Service-Master is designed to speed up your work — styled to reflect the ability of your firm. Its six weathertight compartments include shelves and bins for the tools and parts you'll need on the job.

Whether your chassis is old or new — you'll find it economical to choose *Service-Master* for your next service body.



1. Weathertight, double-panel doors.
2. 48½" wide loading area, with one-piece ribbed steel floor.
3. Fully enclosed wheelhousings.
4. Parts bin with hinged cover and removable dividers.

SERVICE-MASTER is Delivered *Ready-for-Work!*

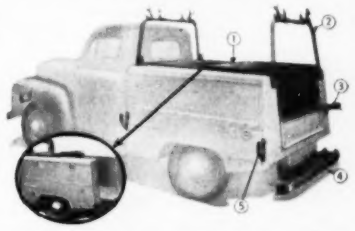


Service-Master sets the pace in service body styling. Compare it with any other make for completeness, design, and advertising value.

◄LOOK FOR THIS NAMEPLATE!

OPTIONAL EQUIPMENT

1. Telescopic steel roof, and endgate with locking handle.
2. Removable rack with adjustable ladder and material brackets.
3. Removable vise bracket with pipe support on head panel.
4. Rear bumper-step.
5. Pipe carrying brackets.



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Company_____

Address_____

City_____ Zone_____ State_____

BY

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(drawout or stationary)

"Concentrol" motor control centers

panelboards

feeder & plug-in bus duct

unit substations

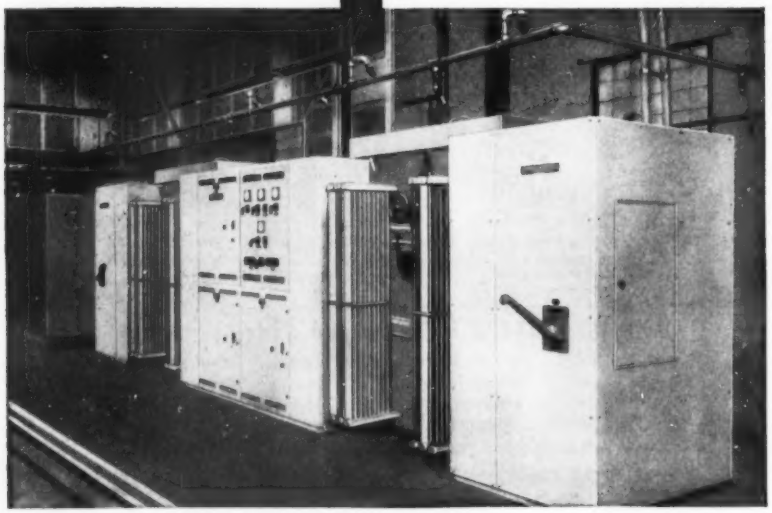
instrument panels

"Weather-Loc" enclosures

theater switchboards

wireway

• • • the modern, low-cost "packaged" method of supplying power. This Continental installation is a 3000 KVA Double Ended Unit. With Continental equipment, you can coordinate your complete electrical distribution system. And, Continental craftsmanship gives you top performance and appearance value.



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High voltage sections: Load Break Air Interrupter Switches.
Transformers: Askarel Immersed, 1500 KVA, 3-Phase, 12,000-480 V.
Switchgear: 600 V., Drawout Type Air Circuit Breakers.
Bus Duct: Continental Low Impedance Feeder Bus Duct.

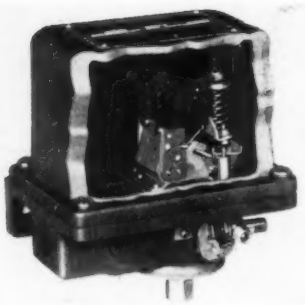
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ELECTRIC EQUIPMENT CO.
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Before you decide on any Electrical Distribution Equipment, be sure you have Continental's engineered proposals and delivery schedules! Your inquiries will be given prompt attention . . . and Continental's standardized equipment will get you into action . . . fast!

Specify Continental . . . with Confidence!



Pressure Switch (17)

A new pressure switch in an explosion-resisting enclosure for water pumps and air compressors. Switch is applicable to conditions where explosive atmospheres are present or highly combustible fuels must be handled. Two types of this control are available. Water pump switch has a 20 to 80 PSI pressure range. Air compressor switch has a 40 to 200 PSI pressure range. Air compressor switch is available with a two-way release valve. Control is adjustable over its entire pressure range. Explosion-resisting enclosure has been designed to meet Class I, Group D specifications. Stationary contact block and movable contact yoke bar are made of non-carbon tracking Rostone. Structure is two pole, double break, silver-to-silver, visible and vertical contact. Operating mechanism is of the positive snap-action type, insuring positive contact regardless of range or differential spring adjustment. Internal parts are treated to resist corrosion.

Square D Company, 4041 North Richards St., Milwaukee 12, Wis.



Ditcher (18)

"Runabout" ditcher, Model 705-B, features new curved tooth bucket line and fluid coupling. A heavy duty Chrysler industrial engine transmits its power through a Chrysler fluid Coupling, to the special "Hydra-crowd" transmission. The digging mechanism is protected at all times, by a constant hydraulic cushion that eliminates shocks, surge loads, and permits appli-

cation of full engine horsepower to task of digging. With fluid coupling, underground obstructions, hidden pipes, boulders, roots, etc. pose far less of a problem. In addition to providing maximum overload protection, the fluid coupling permits application of a steady pressure on the digging face of the trench, permitting ditcher to cut through or uproot obstacles. Forward speeds while digging, range from zero to 16 ft. per min. The digging range is 5½, 7½ and 10½ inches in width and to a maximum depth of four feet.

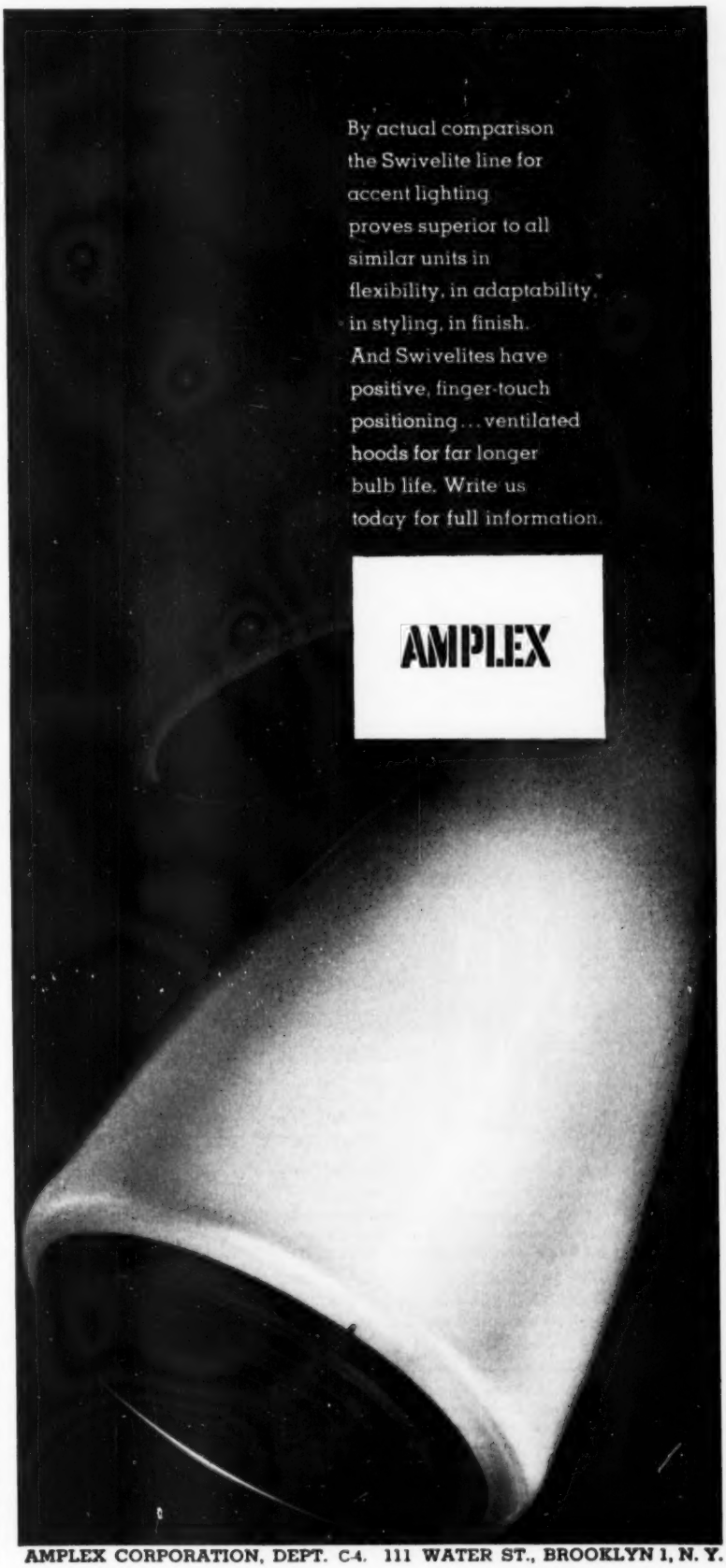
Barber-Greene Company, 400 North Highland Ave., Aurora, Ill.



Air Conditioning System (19)

A new year-round Weathermaker, designed specifically for complete home air conditioning in the $7,500 and up mass residential market. Unit measures 37-in. by 37-in. square and stands 62 inches high. It can be installed in a closet 42-in. by 42-in. square with an access door in front. It provides two tons of cooling and dehumidifying capacity plus winter heating and year-round filtered air circulation in this single closet size cabinet. Burners are available for heating with any type of gas or with oil. For areas where water is scarce, a specially-designed air-cooled condensing attachment is available, eliminating water consumption altogether. Conditioned air can be ducted from top of unit in any combination of four directions or straight up. Return air can be brought back to the back, bottom or side of the unit. All components can be removed or serviced and all connections made from the front of the unit. Unit can be installed immediately adjacent to living areas. It can also be located in the basement, attic or utility room. A single switch can be used to shift unit from summer to winter operations.

Carrier Corp., Syracuse, N. Y.



Seal Out Trouble... *For Keeps* with KEARNEY AIRSEAL



MOISTURE, CORROSION AND OXIDATION

are permanently sealed out of every connection that is protected by this easy-to-use, hand-moulded compound. Even on underground applications, the high dielectric strength and chemical stability of KEARNEY AIRSEAL give ageless, tight-sealing protection and insulation.

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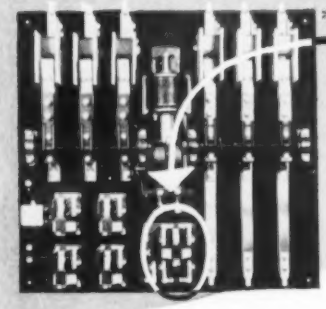
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JAMES R. KEARNEY CORPORATION ST. LOUIS, MO. GUELPH, ONT.

For Better Construction SAFER Maintenance

NOTE this added Feature* of ASCO Transfer Switches



*TIME DELAY for ignoring Momentary Outages

Essential for More and More Installations

No. 1 of a series, spot-lighting features to look for in adequate Automatic Transfer Switches.

We mean a "Time Delay" feature, factory set for tripping at any point between 1 and 3 seconds which permits the transfer switch to ignore normal source outages caused by transient conditions. This results in smooth handling of the connected load and reduced wear on the starting mechanisms incorporated in automatically started standby units or plants.

We'll be glad to send details of this Time Delay feature; also the story of ASCO Service to Industry on this particular phase of Electromagnetic Controls which is given in a new booklet, "Automatic Transfer Switches", now on the press.

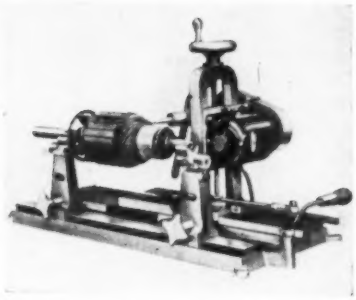
We also manufacture a complete line of "Solenoid Operated Valves" for automatic and remote control of liquids and gases. To thousands of satisfied users, "ASCO" and "Solenoid Valves" are synonymous.

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ASCO Electro-Magnetic CONTROLS

Automatic Switch Co.

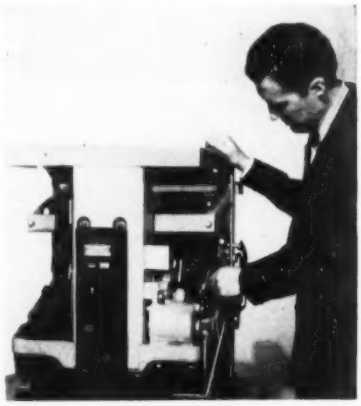
385Q LAKESIDE AVENUE · ORANGE, NEW JERSEY



Undercutter (20)

Model HV-3 is a new bench type undercutter that undercuts both horizontal and vertical commutators. Carriage travels on ball bearings both horizontally and vertically. Undercuts horizontal commutators up to 6½ inches diameter, 6½ inches long; and vertical up to 6 inches diameter. Has 20 inches between centers —one center is spring-loaded but may be locked for heavy work. V-supports are provided for longer shafts; have 1-inch vertical adjustment. Handles armatures 12 inches in diameter on V-supports, 10½-in. diameter on centers. Saw spindle is powered by a Universal, ac-dc, motor. Two ball bearing spindles are available, with ⅛-in. or $\frac{3}{16}$-in. arbors.

Martindale Electric Co., 1309 Hird Ave., Cleveland 7, Ohio.

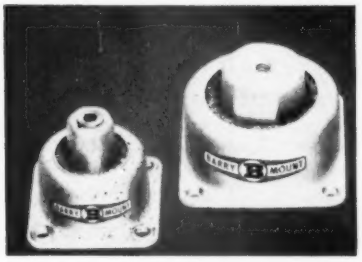


Low Voltage Switchgear (21)

A new line of low-voltage drawout switchgear (600 volts ac and below) with standardized compartment construction and new air circuit breakers. Able to withstand 30-cycle momentary currents equal to their interrupting ratings (15,000 to 100,000 amperes), the new air circuit breakers used in the equipment make it possible to have fully selective tripping with all breakers applied up to their full interrupting ratings. Continuous current ratings range from 15 to 4000 amperes. A feature is the stored energy closing mechanism used for electrical operation of 50, 75 and 100 kva interrupting rated breakers. The new mechanism insures closing and latching against full rated short circuit current even though control voltage is completely lost when breaker contacts first touch. This is accomplished

by energy stored in a spring before closing operation is begun. All breakers are equipped with triple-characteristic overcurrent tripping devices which provide long or short time delay or instantaneous characteristics as required for different applications.

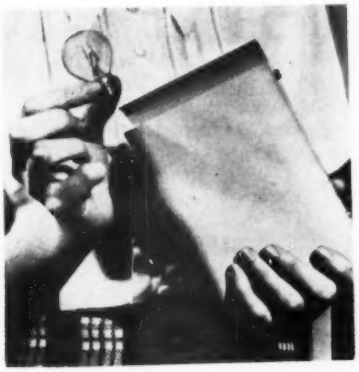
General Electric Co., Schenectady 5, N. Y.



Vibration Isolator **(22)**

Two new all-metal vibration isolators, Type 7630 and 7640, specifically designed to eliminate loss of efficiency due to damper packing. These units are respectively JAN cup-type Size 1 and JAN cup-type Size 2. New units are so designed that the load-bearing spring returns the damper to its normal position on every cycle, thus preventing packing and removing the difficulty.

Barry Corporation, 700 Pleasant St., Watertown 72, Mass.



Deodorizing Lamp **(23)**

A new high ozone producing deodorizing lamp that consumes 4 watts and emits 40% to 50% more ultra violet radiation. Increase in radiation means that more oxygen in the surrounding air is converted into ozone to destroy objectionable odors. Greater efficiency of lamp is due to a bimetal switch. This switch, by automatically opening once the lamp has started, makes it possible to send more energy through arc, thus producing greater ultra violet radiation. Lamps require no starter but operate off small choke ballasts. Ballasts available for single lamp or two, three or four lamps in series on a 110-125 volt ac line. Another method of ballasting is by using it in series with a 40-watt incandescent lamp.

Sylvania Electric Products, Inc., 1740 Broadway, New York 19, N. Y.



gives your production line
TRIPLE PROTECTION
against DOUBLE TROUBLE

1. **UNBREAKABLE Rubber Body** gives contacts maximum protection against impact, weight, pressure. Tested to a tensile strength of over 1200 lbs. per square inch. Will not crack, warp or deteriorate under extreme atmospheric conditions.
2. **STRAINPROOF**—A turn and it's tight . . . and the exclusive locked connection holds under the severest accidental strain or vibration.
3. **SHOCKPROOF**—All-Rubber body assures safe handling under extremes of temperature and humidity. All metal parts specially coated to resist rust and corrosion.

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IDEAL FOR Packing Plants, Breweries, Distilleries, Bottling Works, Dairies, Metal Working Plants, Mines, Tunnels and all other industries which demand maximum safety and performance under difficult conditions.

Available in 2, 3 and 4-wire models

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#2209—2 wire, 20 amp. 250 Volts
#3109—3 wire, 10 amp. 250 Volts
#3209—3 wire, 20 amp. 250 Volts
#2409—4 wire, 20 amp. 250 Volts

All equipped with Rodale patented cord clamps

Send for 1953 TURN-TYTE catalog

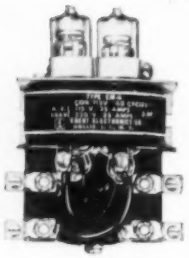
Rodale MANUFACTURING CO., INC.
DEPT. NO. 414, EMMAUS, PA.

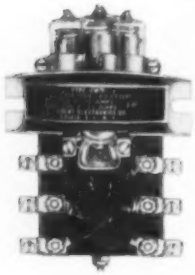
Mercury Plunger Relays

FOR

2 and 3 POLE APPLICATIONS

- Hermetically Sealed
- Silent Operation
- Explosion Proof
- No Maintenance
- Mercury–Mercury Contact





The many advantages of mercury plunger construction are now available in relays for 2 and 3 pole applications.

Compact size and high current handling capacity (up to 60 amps) permits realistic savings in cost and space. For complete details just ask for our free catalogue—and don't forget—our engineering division is ready to serve on any of your relay problems.

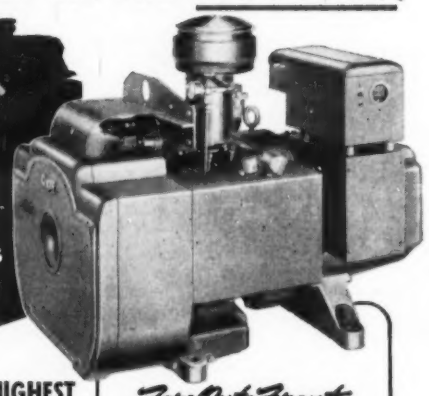
EBERT ELECTRONICS CO.

185-098 Jamaica Ave., Hollis 7, N. Y.

Take a good look at this New Powerhouse*!

THE ONAN "CW" *ELECTRIC PLANT

5,000 or 10,000 watts



LOWEST COST per kilowatt, HIGHEST OUTPUT per pound, MOST COMPACT!

For any use . . . standby, mobile, portable or stationary, the new Onan 5CW and 10CW give you top performance and value! Here, for the first time, are 5 and 10KW electric plants powered by engines *designed and built by Onan exclusively for electric plant use.*

Both engines are 1800 R.P.M. Weigh less and are much more compact than general-purpose engines. Two-cylinder, alternate-firing design. New vacuum air cooling. High-tension magneto ignition. Standard voltages 60-cycle A.C.

For Out-Front IN DESIGN AND ENGINEERING

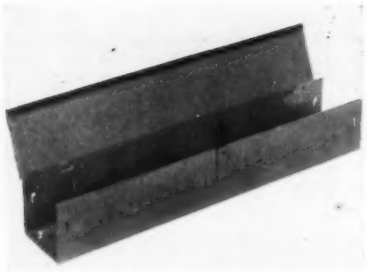
- Twin-cylinder opposed engines
- Aluminum alloy cylinder heads
- Extra-large bearings
- Excellent accessibility
- Pressure lubrication
- High performance generators
- Completely equipped with controls, instruments

Write for folder and specifications

D. W. ONAN & SONS INC.

Onan ELECTRIC PLANTS

8297 UNIVERSITY AVE. S.E., MINNEAPOLIS 14, MINNESOTA



Lay-in Duct (24)

A new and simplified installation method is now being made available to electrical contractors through the introduction of Lay-in duct, a steel enclosed wiring trough for carrying feeders, branch circuits and other groups of conductors. Designed to afford ample protection to wire or cables, the duct is manufactured in standardized sections with a hinged cover and catches for fastening in the closed position. Opening of hinged cover of duct and duct connector provides unobstructed working area to lay-in wires. Connector for duct is square shaped unit with one side hinged by means of a special friction hinge. Telescope attachment provides a means for making connections to lay-in duct fittings at varying distance of approximately 2 to 12 inches. Use of adapter fittings adapt lay-in duct to square duct and also serve to connect duct to panelboard cabinets or switchboards. Available in 2½-in. by 2½-in. and 4-in. by 4-in. sizes in standard lengths of 1, 2 and 5 feet.

Square D Company, 6060 Rivard Street, Detroit 11, Mich.



Attic Fan (25)

The "822" attic fan is designed for small homes such as the G. I. and ranch-type, cottages and motels. Because of its low silhouette, it is particularly adaptable to homes in which prefabricated trusses or roof supports have been used and head room is limited. The fan is set in place over the ceiling outlet on rubber feet which isolate any noise away from ceiling

construction. It comes equipped with a ¼ hp motor and belt drive which move the fan blades at 750 rpm exhausting 3100 cubic feet of air every minute. Accessories for the fan include spring-tension shutters of rolled aluminum which keeps out dirt, insects and hot attic air. Also available is an electric timer with an illuminated dial which permits fan to run any length of time shutting them off automatically. Safety fusible links on shutters and timer stop the fan and close the shutter if air temperature reaches the danger point.

Viking Air Conditioning Corp., 5601 Walworth Ave., Cleveland 2, Ohio.



Rectifiers (26)

Standard unit rectifiers, designed to convert ac to dc at the flick of a switch. Units now in stock range from 3 kw to 50 kw or 230 volts dc, output and either fixed or variable voltage, dc units to accommodate any ac voltage or frequency input. Also available are standard input voltages at 60 cycles.

American Rectifier Corp., 95 Lafayette St., New York, N. Y.

Room Air Conditioner (27)

A new room air conditioner styled with a perforated grill, front panel features plastic fluting. The operating panel is glow-lighted for operation in the dark. The controls permit the selection of several methods of cooling and ventilating. The conditioner dehumidifies, filters, circulates and cools the air. In addition fan may be used separately, with the cooling unit turned off to exhaust stale air from the room or bring fresh air into it. Unit is recommended for rooms up to 500 square feet. It operates on a ¼ hp, 110 volt ac motor. Will fit any window from 28 to 48 inches wide.

Viking Air Conditioning Corp., 5601 Walworth Ave., Cleveland 2, Ohio.



Time studies prove that to cut-off, ream, and thread a 2″ conduit by hand takes 7½ minutes. With an Oster Power Vise Stand a man can do it in less than 2 minutes—saving 5½ minutes.

And time is money. Even if your labor cost is only $2.25 an hour and you add nothing for overhead, these 5½ minutes will save you 20c on every piece of 2″ conduit you thread with an Oster Power Vise Stand. If you thread 36 pieces in a day, it adds up to $7.20. Profits to you on other sizes up to 2″ conduit are similar.

The Oster Power Vise Stand delivers these profits because it's fast, dependable, and sturdy. It's simple to operate and easy to move. Even a good man gets tired, but the Oster Power Vise Stand is morning fresh at quitting time... always ready to deliver accurate threads that assure tight, safe make-up.

Your Oster Distributor is ready to help you solve your threading problems. He offers sound recommendations, speedy delivery, and dependable service . . . and he stands behind the products he sells. Contact him for money saving facts, or if you don't know who he is, fill out the coupon below, and send it to us.

THE OSTER MANUFACTURING CO.

2081 East 61st Street • Cleveland 3, Ohio



☐ Send me full facts on the Oster Power Vise Stand.

☐ Send me the name of Oster Distributor in my area.

Name_____

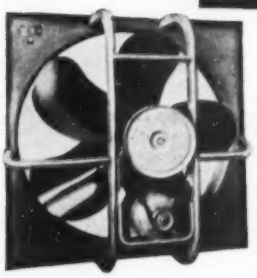
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Address_____

1893 • CELEBRATING 60 Years Leadership in the Threading Industry • 1953

INCREASE your production with efficient—

CHELSEA INDUSTRIAL FANS



TYPE IND EXHAUST FAN
For factories, mills, theatres, schools, hotels etc. Features belt drive with ball bearing motor. Sizes from 24" to 72".

STEP-UP OUTPUT and quality of workmanship, reduce industrial accidents and employee fatigue with proper ventilating and cooling equipment. CHELSEA Fans remove excessive heat, fumes, dirt, dust and grit, also dead stale air. 30 models, in over 200 sizes, are available, and each fan or blower is especially engineered and tested for its recommended application. All ratings are certified by P.F.M.A. test methods to insure proper performance. Check on your ventilating requirements, now.

PROPER VENTILATION IS AN INVESTMENT!

Look for this Seal of ← Certified Ratings
Look for this Symbol ↓ of Quality

WRITE FOR CATALOG NO. 400
Complete data and specifications on fans and blowers for every industrial and commercial application — address requests to Dept. A-4.



TYPE BB ALL PURPOSE EXHAUST FAN



TYPE PHD PENTHOUSE UNIT

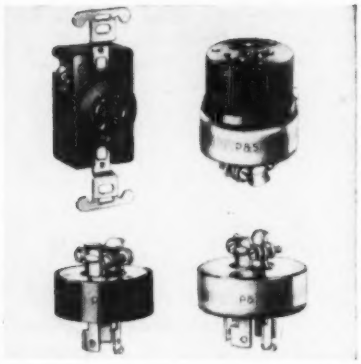


TYPE PLF POWER LINE EXHAUST FAN



TYPE PLDU POWER-LINE AIR BLASTER

CHELSEA FAN & BLOWER CO., Inc.
PLAINFIELD, NEW JERSEY



Wiring Devices (28)

A new line of locking wiring devices, known as the P&S Turnlok line. Designed to provide positive, dependable electrical connections, line includes two, three and four-wire receptacles, caps and connectors, with 10 and 20 ampere ratings. Receptacles and connectors feature contour-controlled contacts which assure positive contact at all times, and modern face design with rating visible, making it possible to tell ampere rating at a glance. Receptacles have two-piece bodies and plaster ears, and are designed for back or side wiring. Heavily armored caps and connectors have large head binding screws and ample wireways for wiring.

Pass & Seymour, Inc., Syracuse 9, N. Y.

WANT the BETTER* TRANSFORMERS?



Open

We build them . . . with modern materials and engineering techniques . . . plus up-to-date design . . . based on years of experience.



Closed

Here is a typical air-cooled 500 KVA class B type. 80°C Rise. 3 phase 4160 Delta Primary + 2½% full capacity taps. 240x480 Delta Secondary. Available from 30 to 2500 KVA with voltages from 2400 to 15 KV.

DISTRIBUTION TRANSFORMERS (DRY TYPE)

MAGNATRAN®

MEETS STANDARDS OF AIEE-NEMA

DRY TYPE
Indoor or Outdoor
3 KVA to 15 KVA
Air-Cooled



*If you think this is just an advertising adjective we invite you to contact us . . . we will tell you who buys Magnatran —the better transformers . . . and if you want, show you how we build them.

WRITE FOR DETAILS

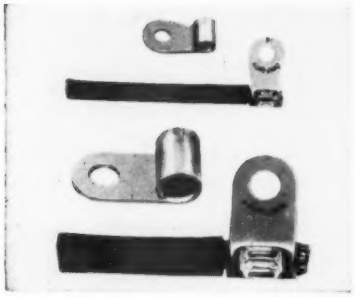
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MAGNATRAN INCORPORATED
TRANSFORMERS AND ELECTRICAL EQUIPMENT
WALTER GARLICK, JR., PRESIDENT
246 SCHUYLER AVE., KEARNY, NEW JERSEY
MAGNATRAN®



Compartments for Trucks (29)

Service-Twins, newly designed tool and material compartments, for ½ and ¾ ton pick-up trucks. Compartments are shipped in pairs, painted inside and out. Finish in medium-dark green, is baked on synthetic enamel that resists rust and chipping. Compartment doors are of double-panel construction and are weathertight. Slam action catches are recessed. Cylinder locks, provided on each door, are keyed alike. Parts bins are provided for each compartment as standard equipment. Bins are equipped with removable dividers. Available in 74- and 84-inch lengths for installation on ½ and ¾ ton pick-up trucks respectively. They can be mounted in a few minutes using only a drill and wrench. Overhead rack, with adjustable ladder brackets, is optional.

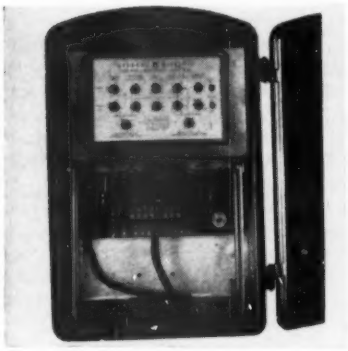
McCabe-Powers Auto Body Company, 5900 N. Broadway, St. Louis 15, Mo.



Terminals (30)

New flag type heavy duty solderless terminals are available for eight wire sizes from No. 8 to No. 4/0. Tongues are designed for a wide range of stud sizes. Made of copper, they are electrotinned for maximum conductivity and surface protection. Because of characteristics of AMP Solistrand crimp, these terminals can be used with solid, stranded, or irregularly shaped wires or combinations of these types. Precision crimping of terminals is quickly done with AMP hand hydraulic tool, which will handle the entire size range. AMP pneumatic hand tool can be used to crimp sizes No. 8 through No. 1/0.

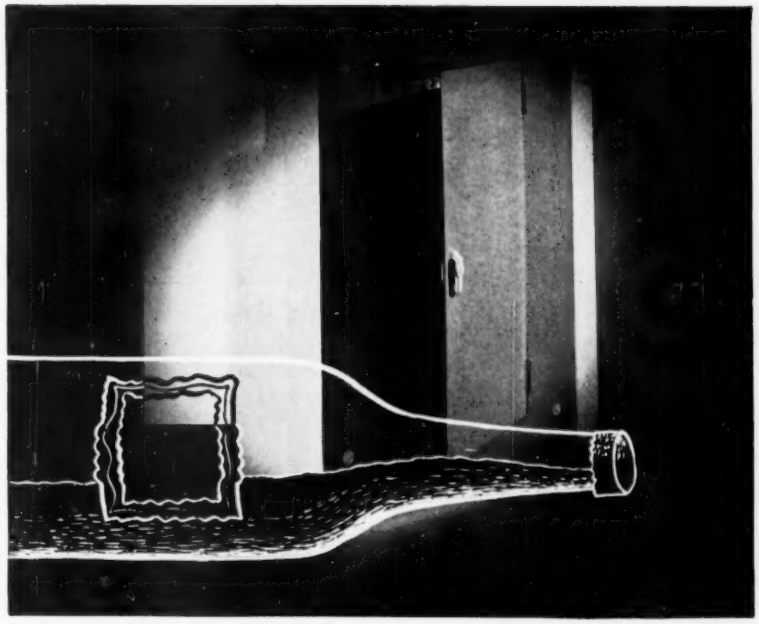
Aircraft-Marine Products, Inc., 2100 Paxton St., Harrisburg, Pa.



Traffic Controllers (31)

Two new lines of vehicle-actuated traffic controllers, each having standard interchangeable jack-mounted components in the assembly. One of the lines, called Type W, provides the only completely non-electronic traffic controllers commercially available, while the second line, Type V, consists of electronically timed devices. Both semi- and full-actuated models are available in each line. Controllers are capable of detecting intersection traffic flow and allocating "right-of-way" to each street in accordance with relative volumes. In a typical installation, vehicle detectors are placed in all approaches to an intersection so as to evaluate the traffic flow. Traffic actuates the vehicle detectors which in turn relay signals to one of the controllers. A signal-timer interpolates these signals and allocates the right of way in accordance with the density of traffic detected.

General Electric Company, Schenectady, N. Y.



Your panelboard may be your bottleneck

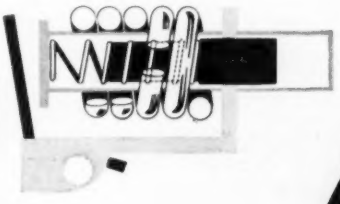
YOUR branch circuits may be wired for 30 or 50 amperes, but do you *really* get that power through your panelboard? Do you have frequent power interruptions during periods of high production . . . particularly in hot weather?

Plant engineers are breaking this nuisance bottleneck by replacing with HEINEMANN Circuit Breakers. The current carrying capacity of HEINEMANN Circuit Breakers does not vary with temperature; nor do the set tripping points. De-rating is never necessary . . . 50 amperes means 50 amperes of usable capacity in your branch circuits. There is never nuisance tripping with the accompanying costly production delays.

HEINEMANN Circuit Breakers operate on a hydraulic-magnetic principle. They provide inverse time delay to allow for starting inrush and harmless, momentary overloads . . . yet they provide the fastest circuit interruption available on large overloads or short circuits.

HEINEMANN Circuit Breakers pay for themselves in another way, too: They have low wattage loss which reduces the current consumption in the panelboard itself . . . a considerable long-term saving.

don't use heat ...USE POWER

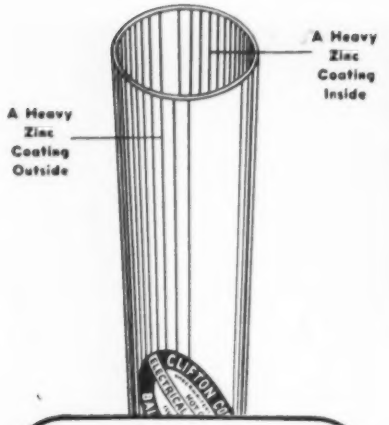




Write for Bulletin 3101.

HEINEMANN ELECTRIC CO.

147 PLUM STREET • TRENTON 2, NEW JERSEY



CLIFTON E.M.T.

gives you

DOUBLE THE ZINC PROTECTION

of ordinary E.M.T.

Because of this extra protection, you can often substitute CLIFTON E.M.T. for rigid conduit—and make substantial savings. Wherever electrical metallic tubing is acceptable for outside installations, CLIFTON E.M.T. can be used with complete confidence.

Hot-Dipped Galvanized

CLIFTON E.M.T. is hot-dipped galvanized by a special process which deposits a uniformly heavy coating of zinc inside as well as outside the tubing, and bonds the coating to the steel tubing. Will not flake or chip.

OTHER CLIFTON PRODUCTS include Rigid Conduit, Flexible Steel Conduit, Armored Cable and Pierceway Plastic Duct Wiring Systems.

Listed by Underwriters Laboratories, Inc.

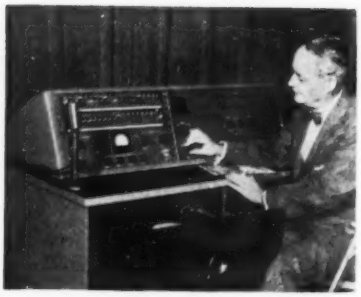
WE MAKE NO BONES ABOUT IT . . .



CLIFTON PRODUCTS ARE THE BEST IN THEIR FIELD

CLIFTON CONDUIT CO., Inc.

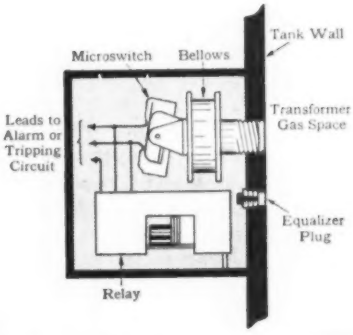
General Offices
75 Montgomery St.
Jersey City 2, N. J.
Factory: Baltimore, Md.



Sound Control Consolette (32)

A new sound consolette for communications and administrative control of sound systems in schools, hospitals, hotels, and industrial plants. Type MI-14937 single-channel desk-top consolette is designed to provide recorded programs, radio programs, or local-origin sound programs and announcements to selected areas or to all areas reached by sound system involved. Unit serves up to 20 rooms or areas, but can be expanded to 60 rooms if required. Provision is also made for adaptation of program channel for intercommunication use when desired. A separate intercommunication channel is available. Radio tuner, record player, and transcription turntable may also be used. Units may be mounted on a standard table or desk, or on any of several RCA unit-built cabinet bases to form a complete control and program console. It measures 11 inches high, 16 inches deep, and 45 inches wide over-all.

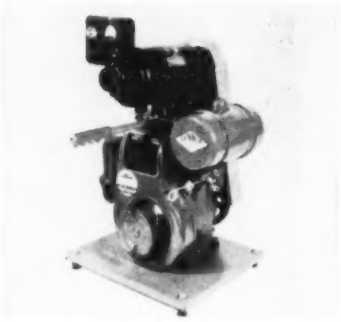
RCA Victor Division, Radio Corporation of America, Camden, N. J.



Pressure Relay (33)

A new sudden pressure relay that protects power transformers from internal faults is available. Operating on rate of change of pressure, it is not affected by pressure changes. When an arc breaks down transformer oil, the increased gas pressure is transmitted from transformer case to relay device through a small tube. Pressure differential is "throttled" through tube and actuates a bellows that is sensitive to a rate of rise of pressure as low as approximately one ounce per square inch per second. A microswitch connected to bellows will either sound an alarm or trip a breaker to take the transformer out of service. Faults that produce rates of rise of pressure of 10 to 15 pounds per square inch per second cause relay to operate in two or three cycles. Rates of 40 psi per second cause operation within $\frac{1}{2}$ cycle.

Westinghouse Electric Corporation, Pittsburgh 30, Pa.



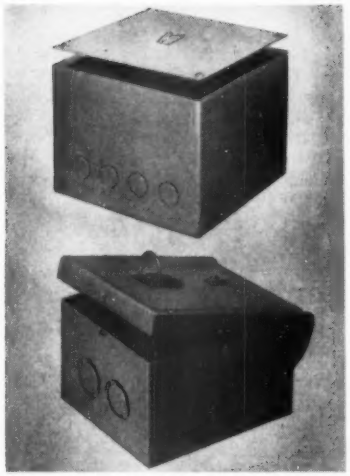
Generator Plant (34)

A new engine generator plant, called Lynnco Powerhouse. Generator is mounted on vibration insulators above the engine cylinder head. Plant illustrated has a maximum output of 3,000 watts, and a continuous rating of 2,000 watts, 115 volts, single phase, 60 cycles; and occupies an overall floor area of 18-in. by 20-in. and is 29-in. high. Complete plant weighs 150 pounds and by removing four nuts, generator may be lifted off so that set breaks into two pieces. It is particularly adapted to use by home owners in event of power failure from storm, floods, war damage, or other causes. It will supply sufficient current to operate the usual electrical devices in the average farm or large home, including deep freeze, milking machine, refrigerator, washing machine, water pump, lights, power tools and radio. Features are built-in voltmeter and control box with two twist-lock outlets, overload protection fuse, sealed lifetime lubricated bearings in generator, tapered roller main bearings in engine.

Lynn Engineering & Supply Co., Russ Building, San Francisco 4, Calif.

Pull Boxes (35)

Two new types of pull boxes have been added to this line. Type "A" hinged cover surface cutout box is designed for electrical cutouts, signal, telephone, junction and pull box applications. It is equipped with a flush ring and friction catch to comply with code requirements. The hinged cover



telescopes over the sides, making the box dustproof. Stock sizes range from 4½-in. by 5-in. by 3-in. to 24-in. by 18-in. by 6-in. Type "SC" is a screw cover box, suitable for junction and pull box use. Stock sizes range from 6-in. by 6-in. by 4-in. to 18-in. by 12-in. by 6-in. Knockouts are removable and dustproof. Boxes are furnished either with or without standard concentric knockouts. Special knockouts for individual requirements can be furnished. Standard finish is gray enamel.

Keystone Manufacturing Co., 23328 Sherwood Ave., Center Line, Mich.



Electrode Holder **(36)**

Caddy Type B full insulated electrode holders, 300 and 400 amp. Welding cable is carried through holder body and attached to a replaceable beryllium copper jaw by means of a Cadweld solid copper connection that cannot be overloaded, cannot melt out or burn out, and can neither loosen or corrode. This results in cool operation. It has 80% conductivity at the electrode. Current is carried by the cable which is supported by the non-current carrying, stamped steel body and connected directly to the jaw.

Erico Products, Inc., 2070 East 61st Place, Cleveland 3, Ohio.

NEW DRIVE-IT 320 with BREAK-OPEN ACTION



MAKES SPLIT-SECOND FASTENING TO CONCRETE OR STEEL... EASIER THAN EVER

BREAK-OPEN ACTION for fast, easy loading and extraction makes new **DRIVE-IT** "320" the easiest operating stud driver on the market. This smooth-working action means a greater saving to you on concrete or steel fastenings.



Here are other exclusive **DRIVE-IT** features that make it the best tool available:

ONE POWER LOAD. No need to buy and stock various strength power loads with exclusive **DRIVE-IT** power control method.

AUTOMATIC EXTENSION BARREL allows fastenings inside junction boxes and other recesses. No need to buy and attach extra barrels.

SWIVEL SAFETY PAD of tough rubber and steel protects operator and permits fastenings next to walls.

SAFE two-handed firing sequence and length of tool offer maximum protection. Can't be discharged accidentally or in mid-air.

DRIVE-IT pins are listed and approved by Underwriters' Laboratories.



DRIVE-IT *the original* **POWDER ACTUATED TOOL**

MAIL NOW FOR MORE INFORMATION

POWDER POWER TOOL CORP.
7526-F S. W. Macadam Portland 1, Oregon

☐ We would like a free demonstration of DRIVE-IT.
☐ Please send literature on new DRIVE-IT 320.

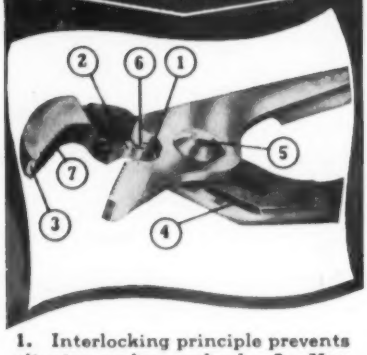
NAME _____

ADDRESS _____

CITY _____ STATE _____

The plier design that OBSOLETES all others

THE NEW No. 420 CHAN NEL LOCK PLIER



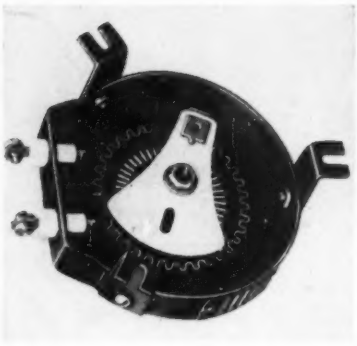
1. Interlocking principle prevents slipping under any load. **2.** New type wide base lugs cannot shear. **3.** New nose design for gripping small objects. **4.** Patented design of tension edge eliminates stress concentration at channels. **5.** New interlocking design minimizes stress on joint bolt. **6.** Precision machined interlocking surfaces result in perfect fit, distributing pressure evenly. **7.** "Rite Angle" teeth guarantee maximum bite and minimum wear.

Here is a plier that will last for years! Channellock Pliers—made only by Champion DeArment Tool Co., Meadville, Pa.

Send for your Catalog today.

Channellock pliers are listed in the Yellow Pages of most Telephone Directories under "Tools"





Rheostats (37)

A new line of Vitrohm pressed steel rheostats, Bulletin 60A, built for a wide variety of industrial control applications. Design features include: a balanced contact arm keyed to drive shaft; smooth control and low operating torque; solid rectangular stationary contacts; a reflexed collector ring; Vitrohm enamel permanently seals resistance element, stationary contacts and collector ring in position. Two types, S (standard) and M (multi-step) rheostats, are available in 6, 8 and 13 inch diameters. Maximum summation watt ratings are 330, 450 and 1000 respectively. Control steps per plate range from 41 to 161. Both types are obtainable with a wide range of resistance values and current tapers.

Ward Leonard Electric Co., Mt. Vernon, N. Y.



Counting Machine (38)

A counting and marking machine, called "Mark-N-Count". Pencil is used to check items or blueprints for estimating purposes. To mark and count certain items in production, taking inventory, checking lists, etc. An audible click registers each count. Knob is turned for resetting to zero.

May Engineering Co., 6055 Lankershim Blvd., North Hollywood, Calif.

Industrial Chilling Machine (39)

Model T-120 industrial chilling machine is designed to provide chilling capacity down to 140° below zero, F., for moderate scale production needs. Thermal capacity of unit will be 1200 Btu per hour at minus 120° F. Chilling chamber capacity is approximately 7.5 cubic feet. It is suited to all industrial low temperature applications—Sub-Zero transformation of austenite in alloy steel, stabilization of steel, normalizing of castings, parts and material testing, etc. External dimensions of unit are 72- by 27½- by 45-inches high. Two motors, ½ hp and ¾ hp, both accessible hermetic, are provided. Temperature can be controlled from minus 70°F to minus 140°F.

Sub-Zero Products Company, Reading Road at Paddock, Cincinnati 29, Ohio



Directional Signs (40)

A new series of illuminated directional signs feature high visibility and cool operation. Opal background on glass, fused in at high temperature to prevent scratching and discoloration, permits even distribution of 15 lumens of light at surface. Rustproof metal construction used throughout. Backplates on surface-mounted (Catalog 25) signs are recessed ¼ inch to cover outlet box projections; are punched for all outlet boxes; have brass grommets to protect wire entrances. Design features quick lamp renewal and special socket holder for installation without taking apart. Lamp centers designed for 10 or 15-watt lamps. Triangular, flush-, corridor-, and ceiling-mounting signs available.

Kelly Specialty Company, 5958-60 Washington Blvd., Chicago 44, Ill.



Type RMC

Air Conditioner (41)

Room air conditioner, Type RMC, has a balance of cooling, dehumidifying, ventilating, and air cleaning. Finger tip controls are located in front. Left hand knob controls switch mechanism. Right hand knob controls damper. Temperature control is available. Tecumseh compressor is counter-balanced, pressure lubricated, and driven by a spring mounted capacitor start motor. Unit uses Freon-12 as refrigerant. Motor drives two fans at 1050 rpm. Evaporator fan is a pressure type blower wheel. Condenser fan has an overlapping blade, pressure type, propeller design. Both fans are rustproof. Available in three sizes for cooling room from 1840 to 3600 cu. ft.

Chelsea Fan & Blower Co., Inc., 639 South Ave., Plainfield, N. J.

ELECTRICAL CONTRACTORS

Again Sylvania extends a helping hand

This Qualified Lighting Contractor emblem helped many electrical contractors make amazing gains last year. Don't miss this latest and greatest opportunity NOW!

QUALIFIED
LIGHTING
CONTRACTOR
AUTHORIZED
SYLVANIA
SALES SERVICE



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The Program is in 3 Parts

Part 1 builds national recognition for the electrical contractor's services through full-page national ads that carry the lighting contractor's emblem in *Time*, *Business Week*, *Newsweek*, and other important magazines. Also sparkling, live commercials on the great TV show "Beat the Clock" will display the emblem to millions everywhere.

Part 2 is a carefully designed publicity campaign to build up your importance as the Qualified Lighting Contractor in your community. You get professionally written talks of interest to clubs and civic organizations. Also free radio and TV scripts, news releases, decals for your windows and trucks. Also ad mats for newspapers and telephone directories . . . all planned to throw a new light on the scope and importance of your services.

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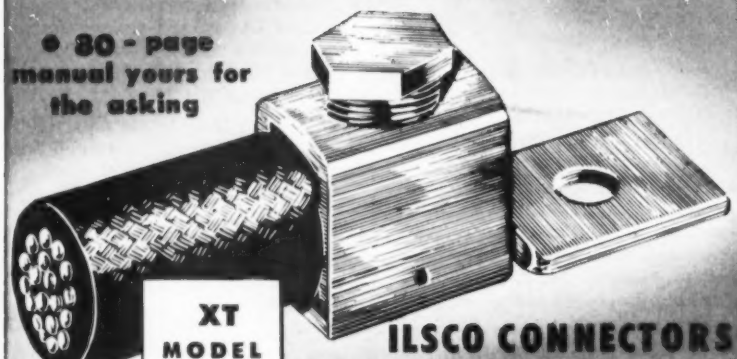
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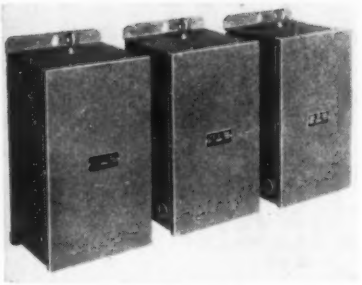
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Lighting Transformers (42)

A new line of general purpose lighting transformers designed specifically for installation outdoors as well as indoors. Designated as "Type C", they are available in sizes from 1 to 15 kva, single phase and three phase, up to 600 volts. They feature Class B heatproof, hi-dielectric, hi-heat insulation with the new DuPont "Mylar" polyester film. To permit mounting outdoors, housing has been redesigned with an electrically welded sheet steel case, and vents scientifically placed to provide weatherproof ventilation. Illustration shows typical installation of three 10 kva units.

Marcus Transformer Co., Hillside, N. J.

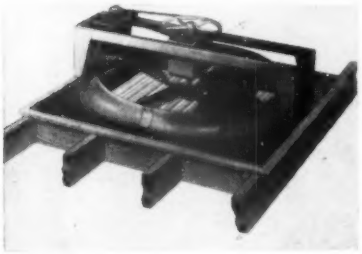


Black Light Unit (43)

A new, high-intensity, long wave Mineralight, Model B-50-H, designed for use as a portable black light inspection lamp in scientific laboratories, and for industrial and agricultural inspection. It is an intense 100-watt long wave ultra-violet hand lamp operating on 110 volt ac. Throws a directional beam of long wave (3660 A. U.) ultra-violet up to 30 feet away. Will clamp rigidly to its non-tip base (containing transformer) and may be permanently locked to any desired position. Unit has easy-to-grip plastic handle, heavy 3-conductor primary and secondary cords and is specially designed to burn cooler. Radiation is non-injurious, harmless to eyes or skin. Unit is useful in detecting oil leaks in machinery or on

fabrics. In addition, the B-50-H in combination with invisible fluorescent inks, dyes, or powders, can be used for industrial or laboratory inspection operations, for the determination of flaws, adulteration, decay or contamination, and for the detection of improper coverage of protective coatings. Streamlined matching hood and base fully enclose bulb and transformer. Both bulb and filter are recessed in hood and switch is located at base of lamp.

Ultra-Violet Products, Inc., 145 Pasadena Ave., South Pasadena, Calif.



Attic Fan (44)

A 36-inch horizontal-discharge attic fan, which comes in several basic components. The venturi cone is in two sections; the blade and power assembly is a unit from which the motor may be detached and replaced to facilitate carrying into attic. Inlet cone nails directly over the hole-framing. Motor and blade unit is floated on four rubber cushions which isolate any vibration away from rest of fan and house construction. Rising only 15½ inches above attic floor it is ideal for the low-roofed ranch-type house. Its four 36-inch blades operating at 350 rpm provide enough air delivery for a complete change of air every one or two minutes in homes from 9,000 to 18,000 cubic feet in volume. Specially-made ball-bearing motor is resilient-mounted. Spring-tension, aluminum shutters and a Minneapolis-Honeywell timer are supplied for use with this fan. Usable in either new or existing homes.

Viking Air Conditioning Corp., 5601 Walworth Ave., Cleveland 2, Ohio.

Electronic Timer (45)

Type 30HL1 electronic timer is recommended for process control machine timing and other industrial applications where long life, repeat-cycle operation is a prerequisite. It is an automatic timer for intervals from 1/20 second to four minutes. It provides four basic types of timing: interval, delayed action, automatic repeat, and programming. The basic electronic circuit is self-compensating for changes in line voltage. Timer employs one electron tube and one relay. Operates on 115 or 220 volt, 50-60

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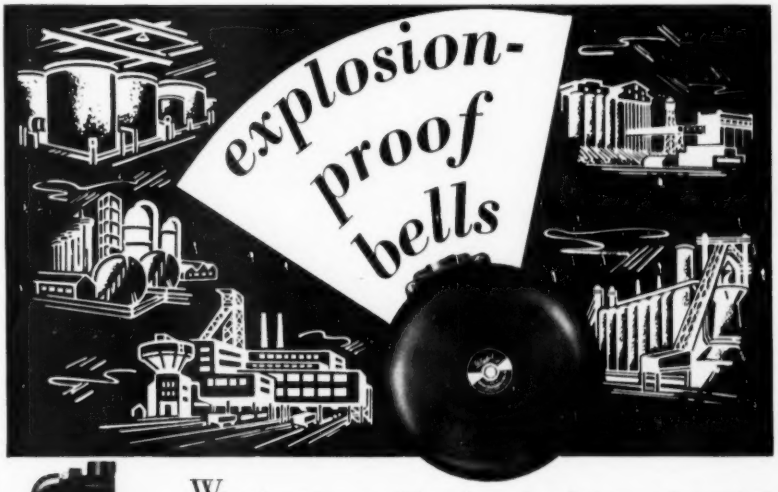
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cycles. Power consumption is 25 watts. Relay is two single-pole, double-throw switches. Main contact rating is 10 amps, 115 volt ac non-inductive, 5 amps, 230 volt ac non-inductive.

Photoswitch Incorporated, 77 Broadway, Cambridge 42, Mass.

Product Briefs

(46) Tork Clock Co., Inc., Mount Vernon, N. Y., has introduced a new electrical appliance, the Tork No. 919 portable plug-in **time switch.**

(47) Acro Tool & Die Works, Chicago, Ill., has announced a new **saw** which attaches to electric or air drills for power. . . . (48) An **island sink** called the Midway, which includes electric outlets on two sides. These allow electric mixers, coffee makers, and juicers to be used on the drainboard without being moved near a wall outlet. Manufactured by American Radiator & Standard Sanitary Corp., P.O. Box 1226, Pittsburgh 30, Pa. . . . (49) Harvel "Oil Stop" manufactured by Irvington Varnish and Insulator Company, 6 Argyle Terrace, Irvington 11, N. J., provides oil **seal** on cable splices where oil pressure is encountered.

(50) Research Products, 88 Exeter St., Boston 16, Mass., has developed **Browlite,** which slips on like a pair of glasses above a pair of glasses. made of plastic in brown, red or black, it comes with pencil-sized batteries and bulb. . . . . (51) A new electric **impact tool** has been developed by Syntron Company Homer City, Pa. A variety of accessories are available.

(52) A new **instrument** for detecting and recording frequency errors in the alternating current output of power plants is being produced by the Industrial Division of Minneapolis-Honeywell Regulator Co., Wayne & Windrim Aves., Philadelphia 44, Pa. . . . (53) The George L. Nakervis Company, 19255 West Davison, Detroit 23, Mich., has announced a new addition to its line of Tru-Tork **dynamometers.** Model 52 Custom, is a "packaged" unit for testing ac and dc electric motors. . . . (54) Double-ribbed **V-belt** for variable speed motors has been introduced by U. S. Electrical Motors, Inc., Box 2058, Los Angeles 54, Calif.

(55) The Steber Manufacturing Co., Broadview, Ill., has announced new **infrared brooders** with improved, and sturdier guards. . . . (56) A new **drafting table,** called Tec-Table, that can be used with an arm-chair or stool has been designed by Tectonic Services, Inc., 2074 East 36 St., Cleveland 15, Ohio. . . . (57) The Electric Service Manufacturing Co., 17th & Cambria Sts., Philadelphia 32, Pa., has announced development of a new aluminum (third-rail) **conductor system** with safety enclosures for powering moving cranes of all types, ore bridges, and allied materials-handling equipment.

CATALOGS and BULLETINS

(58) Lighting Fixtures, fluorescent and incandescent, for commercial, industrial and residential applications, are illustrated and described in 20-page booklet, including specifications on a wide range of recessed, wall-mounting and ceiling mounting units. International Lighting Mfg. Co.

(59) Telemetering is the subject of new booklet, covering use of instruments for remote recording, indicating and totalizing of electric variables over a few feet or many miles, application data and typical installations. The Bristol Company.

(60) Pyrometers, indicating and controlling types, are illustrated and described in 12-page, 2-color bulletin, covering design, application, operating principles, construction and specification on pyrometers and other temperature equipment. General Electric Company.

(61) Home Heating is the subject of 4-page, 2-color folder illustrating and describing portable and wall-type all-electric heaters, with specifications, designs and capacities for all room sizes. Electromode Corp.

(62) Mercury-Vapor lamps are illustrated and described in 25-page booklet, covering application and performance data for all types and sizes of fluorescent-mercury and straight mercury lamps, auxiliary equipment and maintenance. Westinghouse Lamp Div.

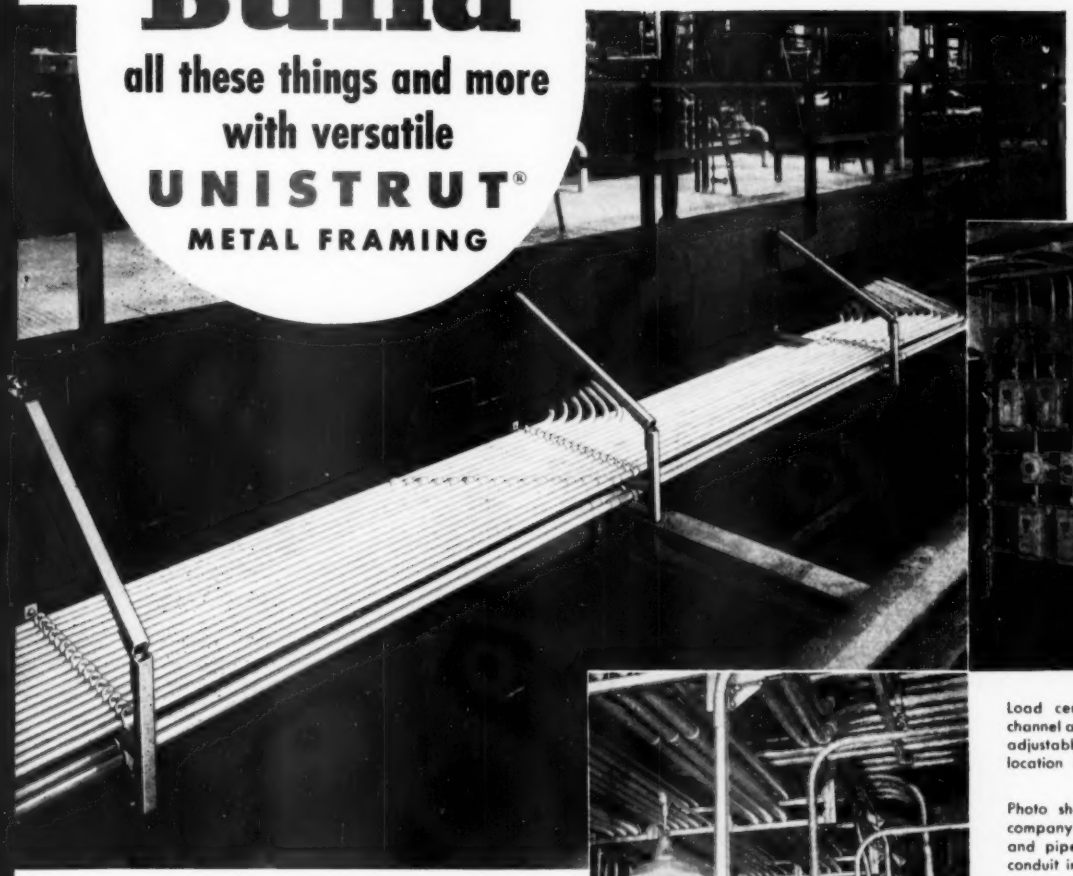
(63) Circuit Breakers, individual pole type, single- and double-pole units, and panelboards for a system of such breakers are illustrated and described in two 16-page bulletins, covering construction, operation, selection of the unit breakers and enclosures and installation of panelboards. Federal Electric Products Company.

(64) Fan Catalog illustrates and describes a range of units from 10-inch blades that move 420 cfm to 20-inch blades that move 10,000 cfm, including table, wall, pedestal, hassock, ventilating and exhaust types. Westinghouse Electric Appliance Div.

(65) Church Lighting fixtures, incandescent, in Gothic, Romanesque, Colonial and Modern motifs are illustrated and described in 12-page Folio, including exterior lanterns in classic

Build

all these things and more with versatile UNISTRUT® METAL FRAMING



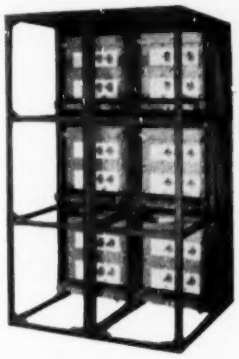
UNISTRUT framing and pipe clamps support heavy banks of conduit leading to motors in plant of large pharmaceutical manufacturer.



Load center built with UNISTRUT channel and fittings. Framing system's adjustable feature permits quick location of gear to spot desired.

Photo shows how a large power company used UNISTRUT framing and pipe clamps to rack rows of conduit in steam plant installation.

Framework of UNISTRUT channel and fittings support switch gear in typical cubicle installation.





Basic Components of the UNISTRUT Metal Framing System

UNISTRUT Products are Bonderized

Rack conduit, cable and pipe—
Frame power load centers—
Mount switches, meters and panelboards

Those who use completely adjustable UNISTRUT metal framing know it's easy to handle and quick to erect—that it provides great strength without bulk—that adjustments, changes and additions are easily made at any time.

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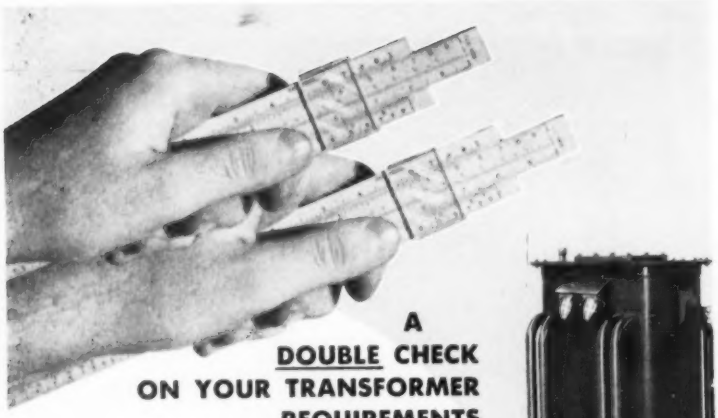
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113 E. 138th STREET, NEW YORK 51

designs, supplemental church fixtures and an adjustable fluorescent pulpit light. Gruber Lighting.

(66) CABLE INSTALLATION equipment, including pneumatic fishline, conduit rods, mandrels, cable pullers, cable racks, reel jacks, torches and other equipment, is illustrated and described in 40-page catalog. T. J. Cope.

(67) BUS DUCT application to distribution systems of commercial, industrial and institutional buildings is described in 12-page booklet, with data from actual installations, typical problems and solutions and the use of allied fittings and accessories. Westinghouse Electric Corp.

(68) HEATING CATALOG contains 60-pages of application data on electric heaters and heating devices, with complete specifications, methods of determining power requirements and installation details. General Electric Company.

(69) ELECTRICAL RELAYS and associated electronic components are illustrated in 24-page, 2-color catalog, including line drawings and general specifications and application data. Sterling Engineering Company.

(70) IDUSTRIAL X-RAY catalog contains 44-pages illustrating and describing a complete and diversified line of accessories and supplies required for an industrial x-ray installation. Westinghouse Electric Corp.

(71) MOTOR STARTERS, magnetic type with vertical overloads below contactor, sizes 0 through 5, for use with the new Crouse-Hinds explosion proof condulets, are illustrated and described in 8-page bulletin. The Arrow-Hart & Hegeman Electric Company.

(72) FLOAT CONTROLS, multi-circuit, for program operation of 2 to 18 circuits with a single float on water, sewage, irrigation and flood control systems, are illustrated and described in 4-page bulletin. Automatic Control Company.

(73) SAFETY SWITCHES, circuit breakers, service entrance equipment (both fusible and circuit breaker types), motor controls, panelboards, distribution systems, and control centers are illustrated and described in 1953 general catalog, with indexed product sections and postcards for further inquiries. Trumbull Electric Dept., General Electric Company.

(74) POWER TRANSFORMERS are illustrated and described in a 4-page bulletin including design and construction,

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(75) RIGID PLASTIC PIPE is described in 4-page illustrated booklet, with specifications, applications and installation data on this pipe and its new compression type coupling. Carlon Products Corp.

(76) ENGINEERING CATALOG on system of all-steel adjustable framing contains 44-pages of illustrated data on line of channels, fittings and accessories, clamps, brackets and insulators. Flexa Steel Products Inc.

(77) TRANSFORMERS, a line of dry type units, are illustrated and described in 4-page bulletin, including specifications and prices. Universal Mfg. Corp.

(78) WIRING DIAGRAM bulletin for ac across-the-line starting switches contains 24-pages of illustrated details on the hook-up of these magnetic switches, with symbols and diagrams for applications of all sizes of starters. Allen-Bradley Co.

(79) APPLICATIONS MANUAL contains 24-pages of practical data on the most effective method of cutting 30 different materials with a portable power saw, including blade selection, cutting techniques and helpful hints. Skil Corp.

(80) PHOTOELECTRIC recorder applications are illustrated and described in 12-page, 2-color booklet, including hook-up diagrams of recorders used for studies in textiles, metals, research testing equipment, light intensity and speed measuring. General Electric Company.

(81) CURRENT CARRYING capacity tables for 0 to 5,000 volt non-metallic sheathed power cables are included in 12-page booklet on cables for direct burial installations, with construction and installation data. The Okonite Company.

(82) MAINTENANCE EQUIPMENT for production work, commutators, motors, electrical systems, safety and mechanical units are illustrated and described in 64-page booklet, Catalog 29, including specifications on the equipment. Martindale Electric Company.

(83) FLUORESCENT BALLASTS for residential, commercial and industrial uses are illustrated and described in 16-page, two-color bulletin, with wiring diagrams, specifications and related technical data on wide range of ballast applications. General Electric Co.

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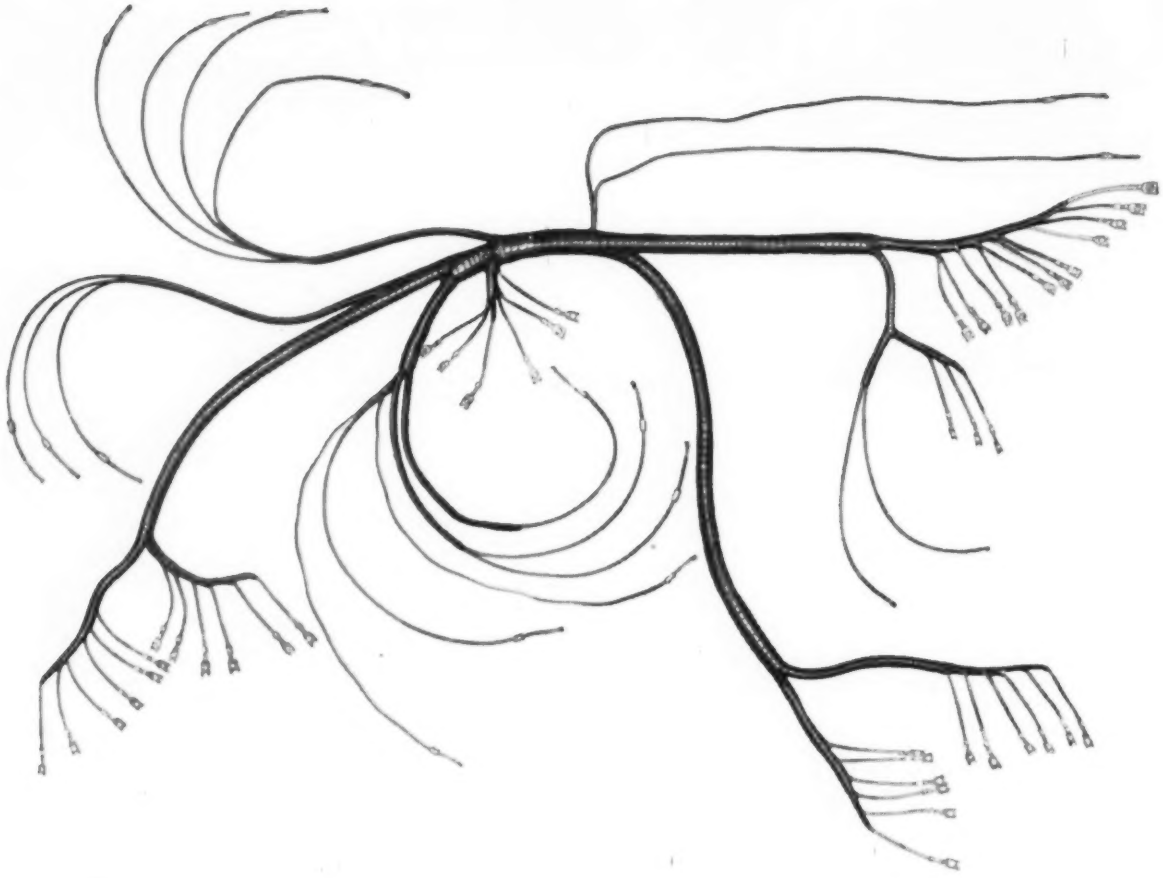


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QUESTIONS from readers on problems of industrial equipment, installation, maintenance and repair. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published we pay $5.00.

Reader's Quiz

Brush Wear On AC-DC Motors

QUESTION S22—We have a number of adding and other office-type machines that contain universal ac-dc brush motors. We have noticed that brush life is shortened when these motors are operated on alternating current when compared to usage on direct current. The machines compared are identical as to make, model, physical condition and overall daily usage and voltage was within 5 percent of manufacturer's nameplate reading. Can anyone explain why brushes wear faster on ac than dc.—L.W.F.

ANSWER TO S22—To start with, universal motors are a compromise between an ac series motor and a dc series motor. Because of this design they spark more on ac than on dc; and outside of wear caused by friction, which remains constant on ac or dc, sparking is the main cause of brush wear. The extra sparking on ac is due to transformer action which induces current in each coil as it is shorted by the brushes. The field acts as the primary and the coil as the secondary. As the circuit is broken by the rotation of the armature, sparking occurs, although it is limited by the design features of the motor. We have found that we always get better results when we replace worn brushes with those specified by the motor manufacturer, as correct brush resistance is very important to proper commutation. —H.G.C.

ANSWER TO S22—Series motors are usually manufactured with the alternative of operation on alternating or direct current. However, there are differences between the ac and dc series or universal motors. The dc motor will operate on ac, but not as efficiently. Therefore certain modifications should be made for most efficient operation. To explain the faster wearing of brushes on ac. than dc, it must be said that excessive sparking at the brushes is the chief reason for the wear as the friction of the brushes on the commutator contributes very little. Certain armature coils are short-circuited, therefore acting as the secondary of a transformer, when a brush covers two commutator segments. This short-circuited condition causes excessive current to flow through the brushes causing the wear. Excessive sparking can be reduced or even eliminated by using high-resistance brushes which are narrower and high-resistance leads between the commutator and armature coils. Here are a few suggestions to assist you in determining whether your motor is an ac or dc series motor: DC Motors—1. Solid pieces of iron for field poles, 2. Low power factor when used on ac, 3. Large number of field turns, 4. Heavier and wider brushes. AC Motors—1. Laminated sheet steel core and poles, 2. Smaller number of turns, 3. Narrower brushes.—J.D.K.

ANSWER TO S22: The shorter brush life experienced in ac operation of universal type motors is due to a "transformer" effect that is not present with dc. An induced current flows in the coils during the instant they are short-circuited while undergoing commutation. The breaking of these short-circuited circuits results in sparking. So the brushes, in addition to their regular function, must also bear the burden of making and breaking these "secondary" circuits hundreds of times per second. This results in greater sparking which leads to a shorter brush life than when dc is used.—E.G.

Telephones Used On Power Lines

QUESTION T22—We have two of the old style wall type telephones with a crank on the side that turns a magneto generating ac current for ringing, and two dry cells for dc talking.

I would like to know if we could use a 115 volt power line for the line wires having a phone at each end (about 2000 feet).

Could resistors be used in each line wire at each phone to hold out the ac voltage and still connect the phone and battery in series to the line for talking?—E.E.M.

ANSWER TO T22—In answer to Question T-22 by E.E.M. the answer is no. It would be cheaper and safer to install a separate phone line for the two old style phones. This type of phone, or for that matter, any type of telephone in ordinary use today, is not made to take 115 volt ac through its component parts and last any length of time. The use of resistors in each line wire to hold out the ac and also the dc from the batteries to power the phones will not work. Resistors are made to reduce voltages in electronic circuits in conjunction with condensers and coils, but in ten years of experience with phones of this type (Army field phones) no such arrangement has ever been worked out. It is a hard and fast rule in the Service that only telephone field wire of the types specified will be used for phone lines. Do not risk safety of persons who may be using these phones by hooking them into ac line wires. It is far cheaper and safer to install a separate line.—J.K.

ANSWER TO T-22—You will need a filter to remove the 60 cycle ac hum at each end and yet allow the higher frequency used for speech to come through. Another filter will be important to feed the low frequency ringing current. The Talk-A-Phone Company sells devices that use the line wires.—H.S.

ANSWER TO T22—The "talking" current on the old type telephone is low voltage dc and the "ringing" current is considerably higher voltage ac so it would be impossible to connect it to the ungrounded wire of the 115 volt line; except through an expensive, complex circuit such as the "carrier-current" telephone used by utilities on high voltage lines. However you can use the grounded neutral conductor, and one more "added" wire for the telephone circuit. The 60 cycle current on the neutral will not affect either the talking or ringing telephone currents. Do not run the added conductor too near the ungrounded LIVE conductor, or the telephone might be noisy when the 115 volt line is carrying considerable load.—M.C.T.

ANSWER TO T22—A coupling communication transformer may help since the voice currents are high frequency. The side of the transformer connected to the power line would have to be connected through a condenser to keep out the power current and allow the voice currents to pass through. In case of the ringing current if it is of the



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high frequency type the proper size condensers could be used in series to allow ringing current to go through and keep out the power current. The higher the frequency of the phone currents the more practical the use of condensers. Of course if there are others using the same method on the power line there will be interference. The system will work best on a small power system when very little power and light is being used. Connect to power line only through small fuses or circuit breakers. It might be advisable to use a handy micro talkie FM transmitter. They weigh only two pounds and can transmit up to 5 miles.—E.B.

Brass vs Iron Slip Rings

QUESTION U22—Wound rotor induction motors have brass slip rings while synchronous motors have cast iron slip rings. Can someone tell me why different metals are used for each type of motor?—M.D.

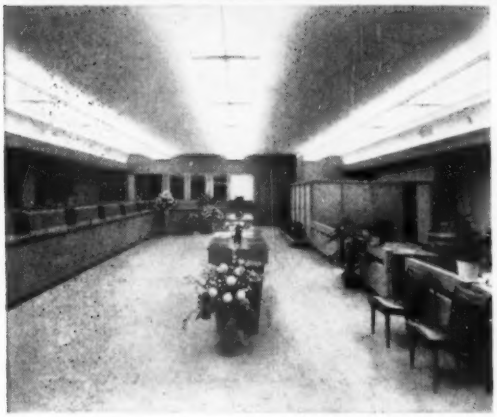
ANSWER TO U22—The current in the wound rotor circuit of an induction motor is usually heavy especially in high voltage machines where it is several times that of the primary circuit. This requires that the resistance of the circuit must be low to prevent heating and abnormal loss. If iron is used in the collector rings of this circuit they would be very large and require a large collecting surface under the brushes to prevent heating. For this reason a better conducting material is used such as copper or brass which has from six to four times the carrying capacity of the iron. This reduces the size of the rings and brushes also reduces the heating losses. In the case of the synchronous motor the only current carried by the rings is the exciting current for the field, this even in a large motor, is a small percentage of the main current and requires little carrying capacity so iron can be used as it is stronger, and costs less. Some older types of synchronous motors have revolving armatures, in which case copper or brass rings are used as the main current of the motor passes over the rings.—A.E.T.

ANSWER TO U22—At lower speeds it would not matter but for a wound rotor induction motor to reach top speed it is necessary that the external resistance to the rotor be as near to 0 as possible. In keeping with this line of reasoning brass is used for the slip rings because it is a good conductor and has fairly good wearing properties. This keeps the voltage drop in the slip rings to a low value. With

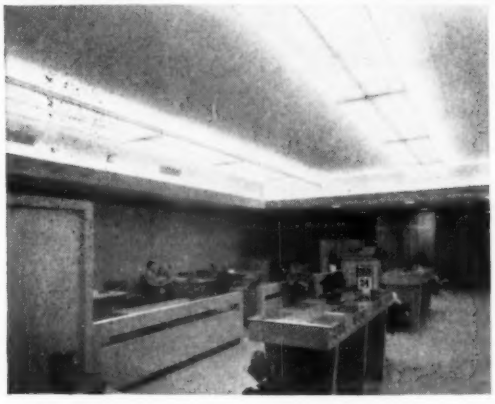
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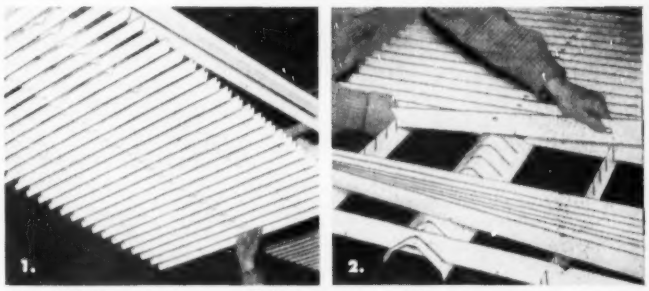


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synchronous motor dc current at a potential of at least 110 volts is sent into the rotor. Since the dc current remains constant the voltage drop in the slip rings is unimportant; so cast iron slip rings are used instead of brass as cast iron will last many times longer than brass.—H.G.C.

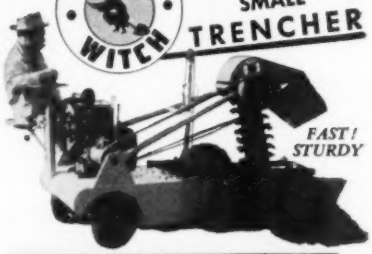
ANSWER TO U22—Collector rings on synchronous machines carry only dc excitation current. A typical 200 hp 1800 rpm, unity power factor synchronous motor requires about 1.3 kw excitation which at 110 volts is about 12 amperes. The secondary current in a wound rotor motor is much larger. A typical wound rotor 200 hp 1800 rpm motor has a rated secondary voltage of 480 volts and a current of 200 amperes. During starting and acceleration this current is much greater. Since the resistance of cast iron is at least 3 or 4 times as great as bronze it is a satisfactory material for collector rings on synchronous machines but not for the larger currents in the wound rotor motor. Standard cast iron rings provide long wearing service in most applications but in plants where severe dampness prevails the rings should be made of bronze to prevent rusting. Most manufacturers will supply bronze rings on synchronous machines at no extra charge if they are requested.

Capacitor Braking For Motors

QUESTION V22—I recently noticed a wiring diagram showing the use of capacitors to brake a three phase motor. These capacitors were connected across the phase leads when the power to the motor was interrupted. How is the braking action obtained? —P.S.

ANSWER TO V22—At the instant that power is removed from the terminals of an induction motor the rotor bars are cutting lines of magnetic flux so that a current at slip frequency is flowing through them. Since this flux does not collapse instantaneously a transient voltage is maintained for an extremely short time at the motor terminals. If, however, simultaneously with the opening of the power circuit, a three phase capacitor of sufficient size is connected to the motor terminals it will supply the reactive exciting current which will maintain the air gap flux in the machine and give rise to induction generator action. The subsequent power loss in the capacitor will quickly dissipate the energy stored in the rotating portions of the machine

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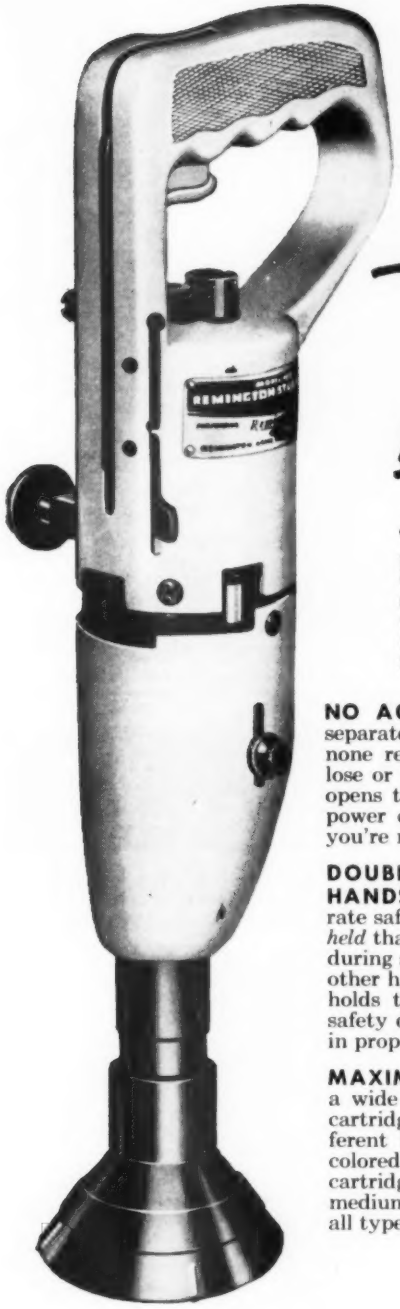
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and dynamically brake it to a standstill. This effect is not present in the case where capacitors are solidly connected to the motor terminals for surge protection or power factor improvement since the capacitors employed for such purposes are too small to supply sufficient magnetizing current for the maintenance of the motor flux.—L.D.B.

ANSWER TO V22—If the capacitors are connected close to the motor and remain connected to the motor leads when the line switch is opened they will produce a braking action due to the fact that the capacitors are charged and start to discharge as soon as the line switch is opened. The capacitors discharge through the motor field coils and establish a field strength in which the rotor is still revolving causing a generating effect, or in other words work is being done by the rotor causing a braking action. If a motor has a power factor of 85%, capacity can be added to increase the power factor to say 100% and obtain a braking effect. If a power factor of 85% is satisfactory twice the capacity can be added causing a greater braking action but the current would be leading and the power factor will drop to approximately 85%.—B.A.S.

Can you ANSWER these QUESTIONS?

QUESTION K23—Please explain the difference between electrolytic condensers for direct current circuits and those for ac motors.—P.S.

QUESTION L23—Can a speed reducer be used on a lower input speed than rated on the nameplate, with the same horsepower rating as given on the nameplate?—E.S.H.

QUESTION M23—Is it possible to reconnect a 20 hp, 900 rpm, 220 volt, 3 phase motor to make a 20 hp, 1800 rpm, 440 volt, 3 phase motor?—E.H.

QUESTION N23—We have two grinders, each powered by a motor of a different make. Both motors are 25 hp, 220 volts, 3 phase, 60 cycle, 69 amps and 705 rpm. On machine No. 1 the motor has a high starting torque and stops quickly when plugged. On machine No. 2 the motor takes longer to stop and start, but it can carry a much larger load at full speed. What could account for this? Is there any way of increasing the load carrying capacity of the motor on machine No. 1?—S.R.U.

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TESTED TECHNIQUES

[FROM PAGE 91]

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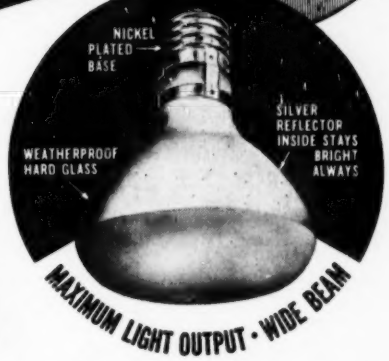
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Small, compact, high-speed motors for operating paint sprayers, sirens and similar applications where duty is intermittent, where load is fairly constant and where constant speed is not essential.

Totally enclosed motors
Use where magnetic or abrasive dusts, extreme moisture, severe fumes or chemical conditions exist.

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Use on water-pump assemblies and similar applications.

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Fractional hp. general purpose, open motors
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Wound-rotor collector-ring motors
Use on jobs where adjustable speed is needed but where slight speed changes under fluctuating load is permissible. Also good for low starting current and smooth acceleration.

Synchronous general-purpose motors
Use where good power factor is desired, where maximum efficiencies are desired for continuous loads of 75-hp. or larger, where exact speeds are necessary, and where low speeds are wanted.

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Fractional hp. general purpose, constant-speed, open motors
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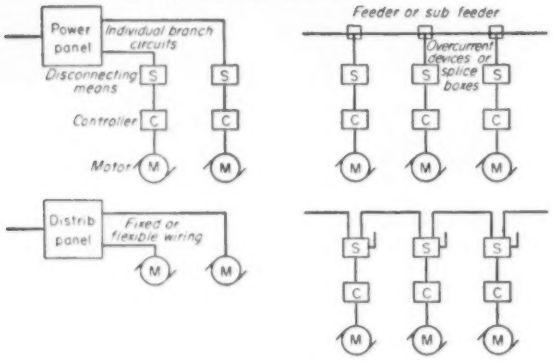
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Recommended for electric instruments, regulating devices, remote-control apparatus and other applications where long life power source at constant speed is needed.

CIRCUITS AND PROTECTIVE DEVICES



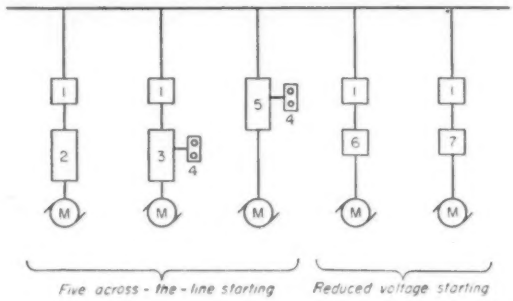
1 — Individual branch to each motor from distribution center.

2 — Feeder or subfeeder with branch circuits tapped at convenient points. Branch circuit over-current protective devices may or may not be included.

3 — Feeder or subfeeder is carried directly to disconnecting means or controller for each motor. Tap conductors are eliminated.

4 — Small motors may be supplied by a common 15- or 20-amp circuit.

OPTIONAL ARRANGEMENTS FOR CONNECTING POLYPHASE MOTORS



1 — Fusible safety switch or circuit breaker
2 — Manual starter
3 — Magnetic starter
4 — Pushbutton
5 — Combination line starter with fusible disconnect or circuit breaker
6 — Auto starter
7 — Magnetic reduced voltage starter

Power may be supplied through cable-conduit, plug-in or trolley-duct, underfloor duct, wireways, etc.

Motor wiring may include remote controls, time switches, adjustable speed devices, etc.

THE THREE CUTLER-HAMMER STARS ★ ★ ★

STAND FOR THREE NEW STANDARDS

☆ Installs easier

The cost of installing motor control today is usually much more than the cost of the control equipment, often two to three times as much. Thus this new control offers *large* savings.





☆ Works better

Users say, "Nothing like this ever before." Smooth, quiet operation with uniform response. New adjustable overload protection lets motors work harder with fewer nuisance interruptions.



☆ Lasts longer

Revises all existing ideas of long trouble-free life in motor control. Cuts rate of wear to point that maintenance care and cost are virtually eliminated for 90% of all control uses.

Look for the three silver stars on the famous Cutler-Hammer nameplate; they identify the new spectacular Cutler-Hammer ☆☆☆ Motor Control. These three stars stand for three entirely new standards in motor control satisfaction and value. ☆ 1 . . . Easier, faster, lower cost installation any electrician can readily prove. ☆ 2 . . . Time-saving, trouble-saving, cost-cutting better performance which any test will confirm. ☆ 3 . . . Amazingly longer life due to advanced engineering features anyone can understand. Compare it by features and by performance. You too will say it is the finest control you know. CUTLER-HAMMER, Inc., 1310 St. Paul Avenue, Milwaukee 1, Wisconsin.

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PROVE IT!

Order from your nearby Authorized Cutler-Hammer Distributor today.



CUTLER-HAMMER ★ ★ ★ MOTOR CONTROL

CUTLER-HAMMER ★★★ MOTOR CONTROL

The 3 Stars stand for 3 New Standards

☆ 1...An entirely new standard of easier, faster, lower-cost motor control installation. Any electrician can prove it.

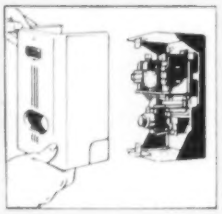
☆ 2...An entirely new standard of dependable motor control performance; reliable uniform response and more accurate overload protection. Any use will confirm it.

☆ 3...An entirely new standard of trouble-free long life; surely the finest starters both electrically and mechanically you have ever known. Any comparison shows it.

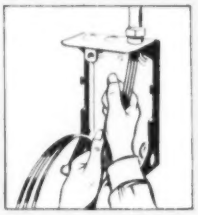
Installs easier...

Factory records everywhere today show the cost of installing motor control is usually much greater than the amount spent to buy the control equipment, often two or three times as much. Here you see why this new, better motor control actually costs less.

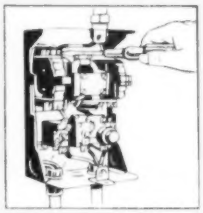
Just loosen two screws and off comes wrap-around cover. Screws stay in cover, do not fall on floor. Just loosen three screws and out comes the entire mechanism on unit plate.



Making conduit connections and pulling wires is a cinch; no starter mechanism in the way. No damaged starter parts or skinned knuckles. Wide-open accessibility, no side walls.

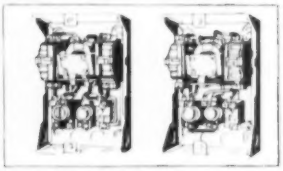


Easy straight-through wiring. All line terminals are at top, all load terminals at bottom. All terminals visible from front, all with solderless pressure connectors. Plenty of wiring room.

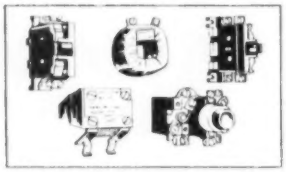


Works better...

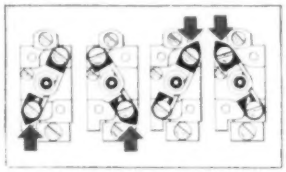
Better performance; dependably uniform operation, trouble-saving and cost-cutting more accurate overload protection. These are more than mere claims in this new Cutler-Hammer control. Field-tested over two years. Compared with every make of control by actual users...to have most say, "Better than anything we have ever used."



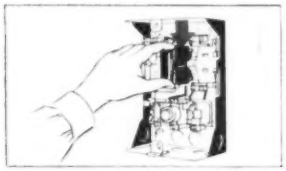
3-Coil Overload Protection. Another Cutler-Hammer "first," complete protection against single phasing as an optional feature in standard starter construction in standard enclosure.



5-Unit Construction. Just five units... magnet coil, armature, two contact blocks, and overload relay...and any unit can be removed from *front* without disturbing any other.



4-Position Overload Coils. Famous C-H Eutectic Relay now adjustable so motors can work harder *safely* without nuisance tripping. Each coil offers range of 4 ratings, selected by positioning.



Electrical Interlocks. Interlock blocks easily added to provide up to 4 extra control circuits; normally open, normally closed, or both.

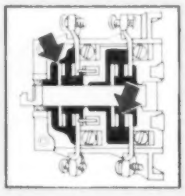
Lasts longer...

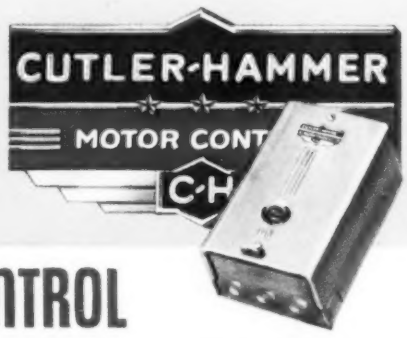
Many users will ask, "Why longer life? We have never had a Cutler-Hammer starter wear out." But there are two reasons for even longer life. First, it brings better performance to those "killer" jobs where industry expects Cutler-Hammer engineering leadership to prevail. Second, and *most* important, it decreases the *rate* of wear to the point where maintenance care and cost are virtually *eliminated* on most installations.

Armature pivoted on a rolling bearing for smooth, quiet operation. No rubbing, no sticking, no slamming. New light-weight moving parts. Less weight, less bounce; less bounce, less arcing.



New pressure-quench arc chambers. Heat of any arc rapidly expands confined air; increased pressure snuffs arc. Contacts are *vertical* dust-safe design; twin-break contacts further minimize arcing.





Cutler-Hammer, Inc.—Milwaukee 1, Wisconsin

CUTLER-HAMMER ★★★ MOTOR CONTROL

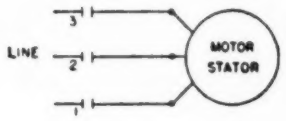
Data Sheet

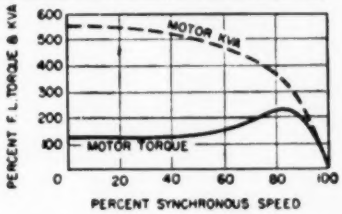
Squirrel Cage Induction Motors

1. FULL-VOLTAGE STARTING

Start: Close 1-2-3

Run: No change

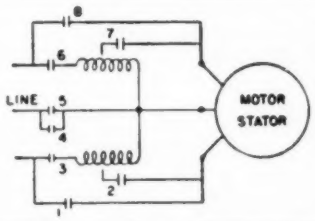


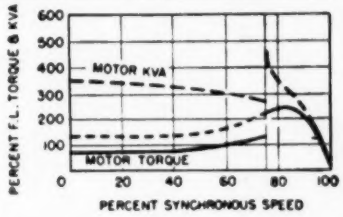


2. REDUCED-VOLTAGE (Auto-transformer) STARTING

Start: Close 2-3-5-6-7

Run: Open 2-3-5-6-7
Close 1-4-8



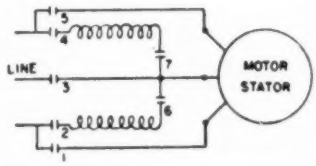


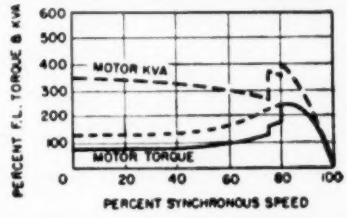
3. CLOSED-TRANSITION (Korndorfer) AUTO-TRANSFORMER STARTING

Start: Close 6-7-2-3-4

Transfer: Open 6-7

Run: Close 1-5



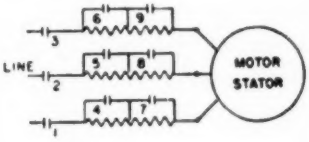


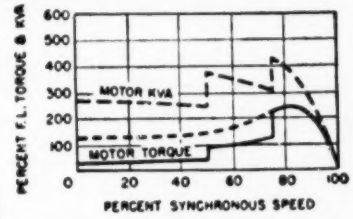
4. SERIES-RESISTANCE STARTING

Start: Close 1-2-3

Second Step: Close 4-5-6

Third Step: Close 7-8-9

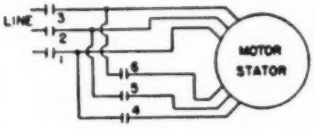


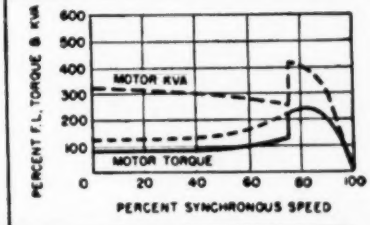


5. PART-WINDING STARTING

Start: Close 1-2-3

Run: Close 4-5-6

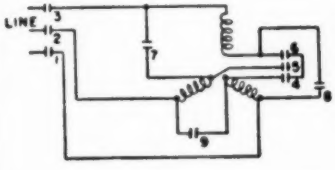


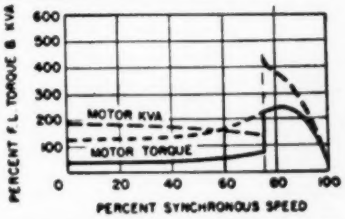


6. STAR-DELTA STARTING

Start: Close 1-2-3-4-5-6

Run: Open 4-5-6
Close 7-8-9

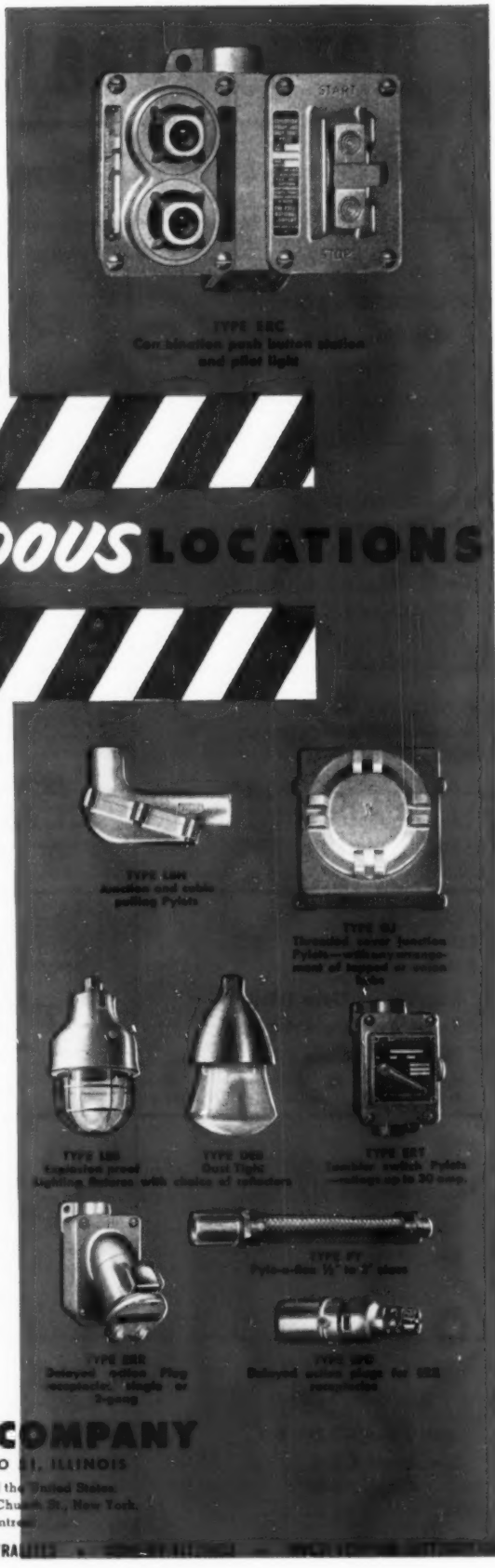




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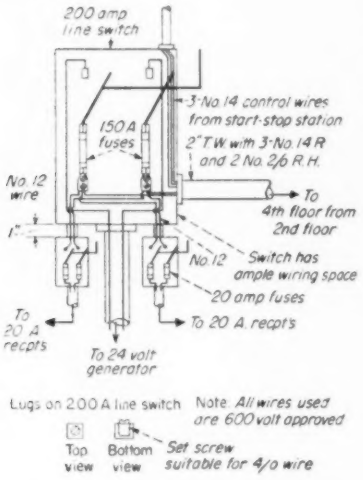
Questions on the Code

Answered by

B. A. McDONALD, *New York Board of Fire Underwriters, Rochester, N. Y.*
GLENN ROWELL, *Electrical Engineer, Fire Underwriters Inspection Bureau, Minneapolis, Minn.*
B. Z. SEGALL, *Consulting Electrical Engineer, New Orleans, La.*
F. N. M. SQUIRES, *New York Board of Fire Underwriters, New York, N. Y.*

Switch Box Used As Junction

Q. *Is the following illustration a Code violation? If so, in how many ways?*—P.P.G.



A. As I understand the illustration, a 24 volt generator supplies current to a 200 ampere main switch with 150 ampere fuses. On the load side of the switch, three taps are taken from one lug. Two of the taps, consisting of No. 12 Type R wire, feed 30 amp. switches with 20 amp. fuses which in turn supply two individual circuits of 20 amp. receptacles. The third tap consists of No. two naught, type R H conductors and supplies 24 volt current to the fourth floor and is run in 2 inch electrical metallic tubing with 3 No. 14, type R, control wires from a start-stop pushbutton station.

Since there is no mention of the loads involved and the size of the main feeder from the generator is not shown, I cannot comment on this feature of the illustration. The voltage of the control circuit and its purpose is not shown but I assume it controls the operation of the 24 volt generator. In the absence of this information, it appears to me that this feature of the installation is involved, only to the extent that it uses the switch enclosure as part of its raceway.

In view of the foregoing, it appears that the main questionable feature concerns the use of a switch enclosure as a junction box for tapping off to other switches; and a raceway for conductors feeding through same. Section 3737 b prohibits such procedure unless special designs are employed to provide adequate space for this purpose. We note your comment advising that the switch has ample wiring space but we are inclined to question this contention and we believe there is a code violation of Section 3737-b. If this 200 amp. switch enclosure is approved for use as shown, it must be of special design, not an ordinary switch, and have adequate space for the additional conductors involved. If we assume this to be the case, we then have several other Code rules involved. I list them as follows:

1—Section 1117. Three conductors connected to one terminal. Such a terminal connection must be of a type approved for the purpose.
2—Section 2434-c. The No. 12 taps at the switch terminal appear to satisfy the 5 ft. tap requirement covered by this section.
3—The number of wires in the 2 in. tubing satisfies the Code requirements covered by Table 11.
4—Section 3011 and 7266 would permit the control wire to be in the same raceway or enclosure provided the limitations are not exceeded.

I do not believe any other important rule is involved. Personally I do not like the arrangement shown. The use of an auxiliary gutter would avoid these controversial questions and provide a better installation.—B.A.McD.

Cable Clamps In Boxes

Q. *Is it not true that when Romex is used for the wiring of homes, it need not be attached or fastened into the box if it is supported within eight inches of that box by a standard strap or clamp? I have done considerable work in the wiring of dwellings on farm properties and the former inspector has always permitted us to use a box without cable clamps when we supported or fastened the Romex within eight inches of the box and now the new inspector insists that I go back on the last job and put cable clamps in each box. Is this a new change in the Code?*—E.D.

A. If on your job you used other than metal boxes, then the Code would accept the installation as you describe, as Section 3710 states under sub-paragraph c. that where non-metallic boxes are used with non-metallic sheathed cable the cable assembly may enter a box through a knockout opening and need not be clamped to the box provided it is supported within eight inches of the box. If you are using other than non-metallic boxes, then you will find under Section 3004 the following requirement: "Raceways and cable assemblies shall be mechanically secured to boxes, fittings, cabinets and other enclosures, except as provided for non-metallic boxes in Section 3710."—G.R.

Fixture Stem Supports

Q. *Does the Code generally require conduit fixture stems to be supported from flexible fixture hanger fittings?*—R.F.

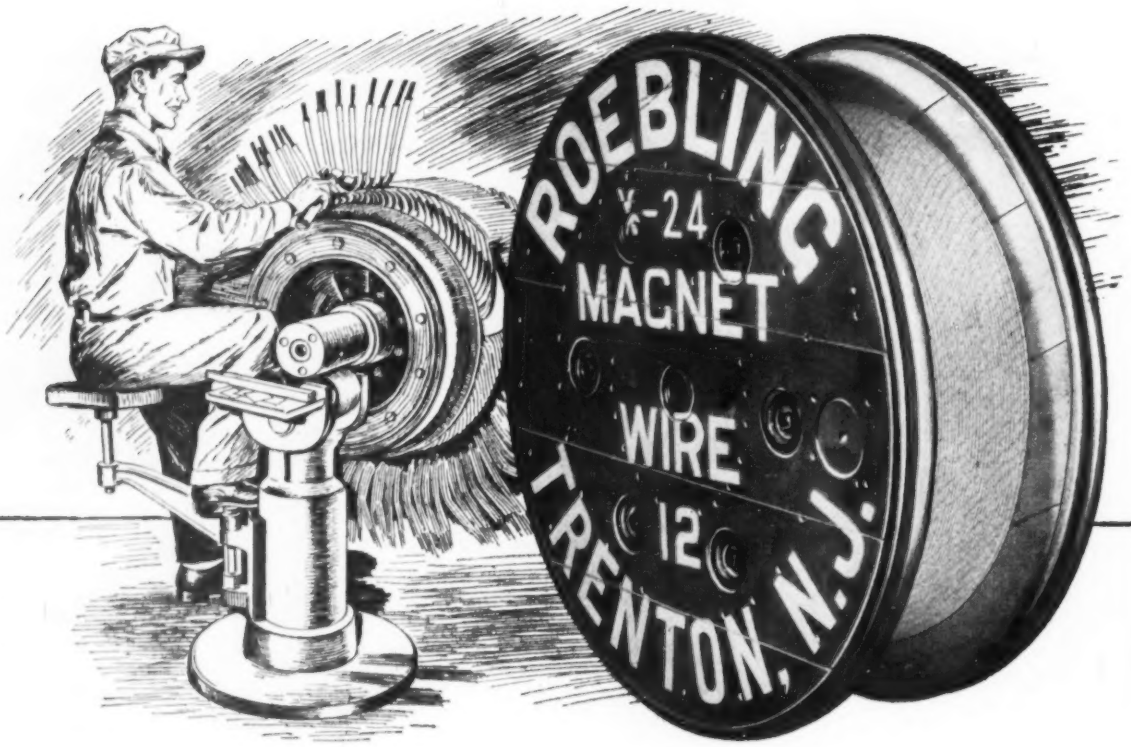
A. The general rules for fixture supports are given in Sections 4131 and 4132.

Section 4131 gives the general requirements and further limits the weight (six pounds) and size (16 inches) of the fixture which may be supported directly by the screw shell of a lampholder. For example, the various types of adapter light fixtures which have combination male and female Edison screw plugs and receptacles for installation into an existing fixture female screw shell lampholder, and which also have some sort of enclosing glassware, reflector or shade attached to this combination device.

Section 4131 deals specifically with the attachment of the fixture to the outlet box or fitting. This requires that the outlet box or fitting give "adequate support" to the attached fixture.

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JAR ROEBLING

If the box, for example, is located in a suspended section of conduit or an exposed section of conduit, then the box itself must be secured to some fixed building structural unit as required by Section 3707 so that it will offer proper support to the fixture. The fixture stem itself may be attached to an approved box cover with double locknuts and bushing, provided the fixture weighs less than 50 pounds. This limit of 50 pounds would have to include the conduit stems but in general quite large fixtures may be installed when it is considered that a ten foot length of conduit weighs about 8½ pounds.

If the fixture (and supporting stem) exceeds 50 pounds in weight then the fixture must be supported independently of the box. This may be done in several ways. For example, a fixture hickey may be installed inside of the box and the hickey itself be permanently attached to a fixed building structural unit such as a steel beam, a joist, etc. Another method would be to install an approved flexible fixture hanger fitting (such as a Crouse Hinds type AL fitting) in the conduit line. The conduit straps on each side of the fitting usually installed within six or eight inches of the fitting will give adequate support.

Section 3719 also states some general requirements for the boxes at fixture outlets. These however, do not specifically require the use of flexible connections.

So that for the general run of installations, the use of flexible hangers may not be required even for fixtures with very long stems, say 10 or 20 feet in length. For irregular type of ceilings, such as curved ceiling, sawtooth ceilings, etc., the flexible hanger usually is required to give proper alignment to the fixture stem. From an engineering standpoint the flexible hanger is preferred because in addition to giving a better alignment to the fixture, it also gives better mechanical protection in that the fixture and stem is free to swing when it is inadvertently hit by some moving objects, etc.

In the use of pendant fixtures in hazardous locations the use of flexible hangers may be mandatory. These requirements are set forth in Sections 5019, 5061 and 5079 for Class I, II and III locations, respectively.

Basically, any fixture stem longer than 12 inches will require a flexible connector (such as Appleton's EX series or Crouse Hinds EC Series) or a flexible fitting such as Appleton's Type ESD, if the stem is not effectively braced "against lateral displacement" within 12 inches above the lower end of the stem.—B.Z.S.

Ammonium Nitrate Storage

Q. *What type of installation is now required for ammonium nitrate storage magazines since the Texas City disaster has proven it an explosive?*—P.Z.

A. I assume that your question principally concerns any hazard which might result from the exposure of ammonium nitrate to electrical wiring and appliances. Since the N E Code does not specifically cover this compound under Article 500, Hazardous Locations, reference to other sources of authority must be made in order to satisfy the question. In order to avoid any misunderstanding in connection with the question, I wish to refer your attention to an article published in the April 1952 quarterly of the National Fire Protection Association which was condensed from Manual A-10, issued by the Manufacturing Chemists Association Inc. This Manual may be obtained from the Association at 246 Woodward Bldg., Washington 5, D. C. at a cost of 50 cents per copy. I also call your attention to a paper presented by C. Y. Thomas of the Spencer Chemical Company, Pittsburg, Kansas which is published in the proceedings of the 56th Annual Meeting of the National Fire Protection Association, held in New York on June 9-13, 1952.

Reference to these articles indicate that fertilizer grade ammonium nitrate, known as FGAN, was involved in the Texas disaster. This compound is classed chemically as an oxidizing material and the principal hazard concerns its ability to support combustion when it is involved in a fire. According to Mr. Thomas, there is not as yet a satisfactory answer to Texas City in the minds of many of us who are handling, day in and day out, hundreds of tons of this chemical with no unfavorable results.

In connection with the electrical hazard, both the Manufacturing Chemists Association, Inc., and the National Research Council of Canada recommend that this material "should not be stored closer than 3 feet from steam or hot water pipes, radiators, heating devices or electric wiring fittings or switches" (quoted from National Research Council.) This appears to be the only consideration given to the electrical hazard involved.

In order to further clarify the matter in your mind, I suggest that you obtain a copy of Manual A-10 from the Manufacturing Chemists' Association at the address already shown. This opinion has been confirmed by the NFPA—B.A.McD.

Single Pole Switch

Q. *I inspected an air compressor installation which consists of a 5 hp single phase, 220 volt motor provided with only a single pole pressure actuated control switch. The circuit supplying this motor is extended across the ceiling with a T in the conduit and about a 7-foot nipple down to the pressure operated switch which is located on the compressor. The wireman has brought down a single conductor on one side of the 220 volt circuit to this pressure switch and while I am convinced this is a violation of the Code even though the circuit has a disconnect switch back on an opposite wall, I would appreciate being advised of the section of the Code in which I will find this rule.*—A.A.

A. The use of a single pole would, of course, be in conformance with Code as Section 4384 states that except where a controller serves also as a disconnecting means, the controller need not open all conductors to the motor. Under Section 3018 you will find the requirement that on alternating-current circuits where run in metal raceways or cable armor, the conductors of the circuit shall be so arranged as to avoid overheating of the metal by induction. Then in the fine print note following this section you will notice that induced currents in an enclosure can be avoided by so grouping the conductors in one enclosure that the current in one direction will be substantially equal to the current in the opposite direction. In other words, the Code requires all conductors of a circuit to be contained within the same raceway except where the capacity is such that it is necessary to multiple conductors to carry the amperage, in which case it is possible to use more than a single raceway provided all conductors in any one of these raceways are balanced in size and include a conductor from each phase. Therefore, in the case in question the second conductor should have been brought down in the same conduit run to the pressure actuated control switch even though it made no contact to that switch.—G.R.

Large Service Switches

Q. *Our inspection department was recently asked to approve a special fused knife switch as a service switch for an underground 4000 ampere, 120/208 volt service to a building. We could not find any Under-*



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writers' Laboratories Inc., approval for such a switch. Is a knife switch rated above 1200 amperes at 250 volts approved for service equipment?—H.S.

A. This is a very interesting question and has quite an interesting Code history. Up to and including the 1937 Edition of the Code, Section 3813 (of the 1937 Code—there were other numbers for this section in previous Codes due to the general rearrangement of the Code made about this time), in toto stated:

"3813. General-Use Knife Switches, Rating. Knife switches rated at more than 1200 amperes for switches of 250 volts or less, and 600 amperes for switches of 251 to 600 volts, shall not be installed as general-use switches."

It should be noted that, in effect, this rule would prohibit the use of knife switches as service switches, if their rating exceeded the values shown in this code requirement.

There were in use in New York at this time some specially designed fused knife switches serving as service entrance switches for a large store load. The rating of these units was 4000 amperes, 120/208 volts. These switches were manufactured by the Pringle Electric Manufacturing Co. of Philadelphia, Pa. Before being installed they had been thoroughly tested in the laboratories of the Consolidated Edison Co. of New York, as they had facilities for making such tests.

These special switches have high capacity fuses of non-standard design and cannot be tested at present in the Underwriters' Laboratories, Inc. since they do not have a standard set up for such fuses. Here again it must be pointed out that these special fuses were thoroughly tested in the aforementioned New York Utility's Laboratories and found to have excellent protective characteristics. The switch mechanism itself is arranged so that immediately after the switch blade is closed and set into both the line and load jaws of the switch, a bolting mechanism is brought into play. This mechanism is now actuated by the further movement of closing the switch handle and in so doing bolts the switch blade against the switch jaws and hinge.

One of the Inspector members of the then existing National Fire Protective Association's Electrical Committee brought to the attention of the Committee members that he had approved this special switch as service equipment. He requested that this Section 3813 be amplified so that he would have definite Code backing for his approval of this switch, which had been fully tested to his satisfaction. In the 1940 Code a second sentence was

added reading as follows:

"To interrupt currents greater than 1200 amperes at 250 volts or less, or 600 amperes at 251 to 600 volts, a circuit breaker or *a switch of special design approved for such purpose* shall be used."

Since the Code has set up the definition of "Approved" as "Acceptable to the authority enforcing this Code", this gives any inspector the right to approve such special switches if he desires to do so.

This Pringle "Bolted Pressure Switch" has since been given special approval by inspectors in many parts of the country. Until such time as Underwriters' Laboratories, Inc. can develop the proper procedures and test for such a fused switch, this special approval procedure will have to prevail.—B.Z.S.

Grounding Washing Machines

Q. *Section 2124b of the Code requires, in a dwelling occupancy, a 3-pole receptacle designed for grounding, to be installed for the connection of laundry appliances. Does this rule infer that it is necessary for me to ground the frame of my washing machine which is located in the basement of my home to a grounding conductor which is a part of the nonmetallic sheathed cable which supplies the receptacle?*—E.T.H.

A. While this rule does not specifically require the grounding of your washing machine to a grounding conductor which is a part of the nonmetallic cable, it appears to me that the requirement does infer that such action should be taken when non-metallic cables are involved. The inference however is not, in my opinion, sufficient to require, on the basis of the Code wording, that such procedure must be followed. This rule has been subjected to considerable discussion with respect to its intent during the past few years and I believe it is generally understood that a 3-pole receptacle shall be installed but no provisions for grounding are made. In other words, here is a device for your protection. Take it or leave it.

This matter has received serious consideration by the Electrical Committee and at the present time a new proposal for Code change will make the present rule more effective, if accepted. The new proposal reads: Section 2115-b. Where a grounding receptacle is required as in Sections 2124-b and 2559 the branch circuit or branch circuit raceway shall include or provide a grounding conductor to

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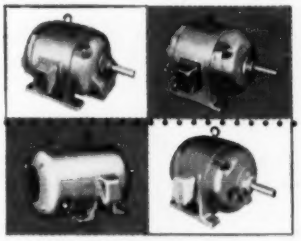
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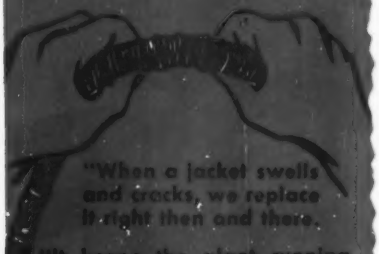
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which the grounding contacts of the grounding receptacle shall be connected. A grounded metallic raceway shall be acceptable as a grounding conductor.

Acceptance of this new proposal definitely answers your question. In the meantime, it is my opinion that your washing machine should be grounded as covered by the new proposal.—B.A.McD.

Signal Circuit

Q. *Under Section 3011 of the Code, we find the statement that conductors of signal or radio systems shall not occupy the same enclosures with conductors of light or power systems. Now does the word "signal" mean circuits used for transmission of intelligence or does it mean in addition circuits used for the operation of sound producing devices, such as a doorbell?* —E.W.

A. If you will look in Article 100 under the definitions, you will find that a signal circuit is defined as any electrical circuit which supplies energy to a device which gives a recognizable signal. Such circuits include circuits for doorbells, buzzers, code-calling systems, signal lights, and the like. Therefore, the term "signal" under Section 3011 pertains solely to circuits supplying energy to devices which give recognizable signals either by sound or by sight. You will find rules and regulations governing the installation of communication circuits used for the transmission of intelligence under Article 800 of the Code and under Section 8012 you will note that communication conductors shall not be placed in any raceway, compartment, outlet box, junction box or similar fitting with conductors for light and power circuits or Class I signal and control circuits unless the conductors of the different systems are separated by a partition.—G.R.

Hospital Operating Rooms

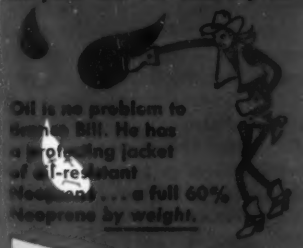
Q. *In designing the circuits for hospital operating rooms a question arose as to the intent of the requirements of Section 5-5c of the NFPA Pamphlet No. 56 "Recommended Safe Practice for Hospital Operating Rooms". Specifically the controversy developed in an attempt to understand the phrase ". . . installed in a conspicuous location . . ." with reference to the green and red signal lamps used in conjunction with the*

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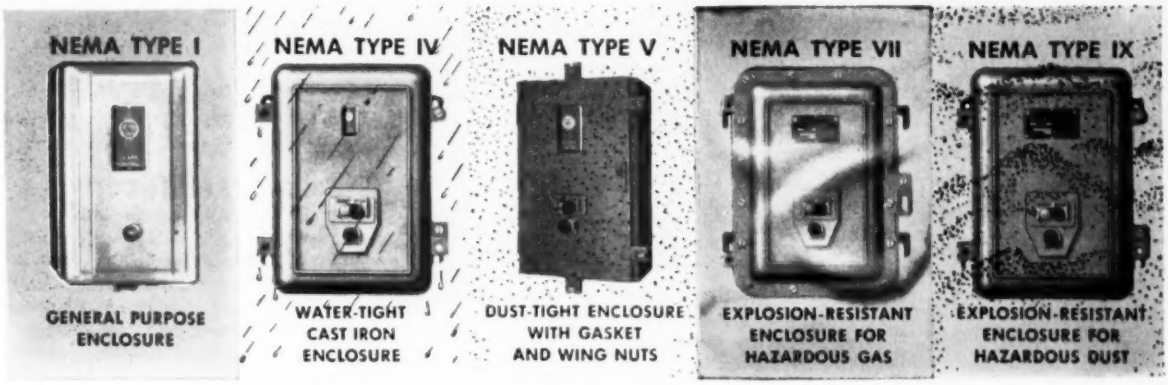
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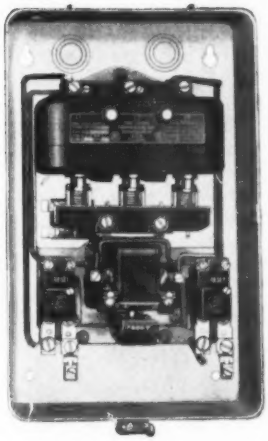
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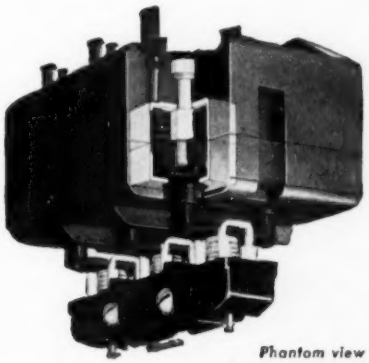


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ground detector device. Do the signal lamps have to be located in the operating room or can they be installed say near a nurse's call station or near the chief engineer's desk or some other conspicuous location?—W.B.

A. The phraseology cited does leave much to be desired for a specific requirement for design purposes. It should be remembered that these recommended regulations are still in the process of formulation, and gradually these rules are being stated more clearly and concisely as to their intent.

The progress in this one particular instance is a very good example of the continual study being given to these regulations in an attempt to clearly emphasize the hazards and methods to be employed to minimize them in a hospital operating room. Thus for example, in Section 14 of this pamphlet covering "Rules and Regulations", a new regulation is to be found in the July 1952 issue. This was not a part of the regulations in any of the previous issues of this "Recommended Regulations".

This new regulation shown as paragraph "g" under Regulation 3 reads as follows:

"When the ground contact signal (red light) lights, the administration of combustible anesthetic agent shall be discontinued at the earliest possible moment. Following the completion of the operation, the operating room in which the signal functioned shall not be used until the reported electrical defect is remedied."

This would seem to indicate that "the conspicious location" should be one readily available to the anesthetist.

As further evidence of the intent, reference should be made to the new sections in Article 510 as shown by the proposed amendments of the 1951 Code in NFPA Electrical Section pamphlet No 70-PR11. On page 94, proposed section 5135f4 in the second sentence also refers to the green and red signal lamps, but their location is required to be ". . . . conspicuously visible to personnel in the anesthetizing location. . . ."—B.Z.S.

Surface Raceways

Q. *Where does the Code cover the number of wires permitted in Wiremold? I am particularly interested in catalogue No. 500. The rule appears indefinite.*—E.T.

A. Section 3524, Article 352 Surface Metal Raceways of the N. E. Code tells us that the number of conductors permitted in such raceways shall not be greater than the number for which the raceway is approved and in no case shall more than 10 conductors be installed in a single raceway compartment. Section 3523 limits the size of conductor to No. 6.

Wiremold is listed by Underwriters Laboratories as a Surface Raceway under their label service and reference to this listing on pages 313 and 314 shows the number of wires permitted in the various types of Wiremold. For example: Cat. No. 500 Wiremold is approved for use with the following number of conductors when no wiring devices are mounted on or in the raceway.

Cat. No.	Wire Size	No. of Conductors R or R H	T or R U
500	14	5	6
500	12	4	6
500	10	2	4
500	8	0	2

Similar Tables also show the maximum number of conductors permitted in the other types of Wiremold. —B.A.McD.

Paint Spray Booth

Q. *One of our customers is applying undercoating to new cars he sells and therefore would like to have us install a hoist within a paint spray booth. In purchasing this hoist, if we specify explosion-proof motors and then mount the controls outside of the booth, will this be acceptable by the Code?*—H.W.

A. No. At the present time there are no motors specifically approved for use in a paint spray booth. Therefore, if you wish to use a hoist in a booth, all electrical equipment used in connection with such a hoist would have to be located outside the booth. This can be done by extending the ram or rams used to lift the hoist through the floor of the booth to a safe area. Under Section 5003 of the Code you will note in sub-paragraph a. that no electrical equipment or apparatus shall be installed or used where it may be subject to hazardous accumulations of readily ignitable deposits or residues. The reason for this is simply caused by the fact that an electric motor or any other electrical energy-using device or appliance must dissipate heat and a conventional Class I motor could not dissipate this heat when covered with a thick coating of paint residue. It is entirely possible that sometime a motor may be developed which has a heat transfer medium employed which will permit such usage. However, until some means other than simple radiation is employed to dispose of this heat, it will be necessary to keep all motors out of areas in which they may be coated with paint residues.—G.R.

Fluorescent Inductive Load

Q. *During a recent final inspection of a construction project, the following question arose: We had installed 10 ampere switches throughout the project, these switches controlling fluorescent fixtures so that the load was less than or equal to the rating of the switches. It was the opinion of the inspector that these switches should have been 20 ampere switches (twice the rated load) and that our installation was in violation of Section 3814, Part 3 of the National Electric Code, which reads as follows:*

"Switches controlling inductive loads shall have an ampere rating at least twice the ampere rating of the load unless they are of the type approved as part of an assembly or for the purpose intended."

It is our contention that the switches provided are adequate and that this Section of the Code does not apply. The fluorescent fixtures contain high power factor corrected ballasts, that is, the inductive portion of the ballast is compensated for, and the load is considered non-inductive.

We would appreciate an interpretation and opinion in this case.—E.A.W.

A. Official interpretation No. 177, issued April 23, 1940 which covered the wording in the 1940 Code under 3814-b, advised that the rule intended to apply to fluorescent lamploads. Interim Amendment No. 57, approved August 11, 1942, intended to clarify all of the points covered by Interpretation No. 177. This amendment is the same as the present wording in the 1951 Code and it first appeared in the 1946 Code. In view of the foregoing, there appears to be no question about a fluorescent lampload being classed as an inductive load.

I am unable to find however any official comment on this rule which clarifies the point you have raised concerning the use of capacitors to improve the power factor of the ballasts. As a result, I may only give you a personal opinion. Underwriters' Laboratories in their 1952 Electrical Equipment List, page 66, makes the following comment:

"Alternating Current ballasts for which high power factor is indicated can be considered as operating at 90% power factor under *normal conditions*. Where the power factor is actually

indicated, the value given can be considered as the approximate power factor under *normal operating conditions.*"

I have underscored the words "*normal conditions*" to indicate the possibilities that whether the ballast operates at 90% or 95% power factor, conditions other than normal, could cause these percents to be lower as in the case of the two lamp application when the corrected lamp fails the other lamp continues to operate at very low power factor. In view of the variables involved and the present Code wording, I believe the Inspector was correct in requiring switches rated for twice the connected load. I also appreciate your reaction. It is reasonable to assume that as the power factor is improved, the need for the protection afforded by the double rating becomes less and if the fixture operated at 100% power factor, it no longer would be an inductive load. At the present time however, the Code does not qualify the meaning of "inductive load" in terms of percent power factor and in the absence of such a provision the Inspector should not, in my opinion, assume the responsibility for such a decision. After all the Introduction of the Code reads, in part, as follows: "Good service and satisfactory results will often require larger sizes of wire, more branch circuits and better types of equipment than the minimum."—B.A.McD.



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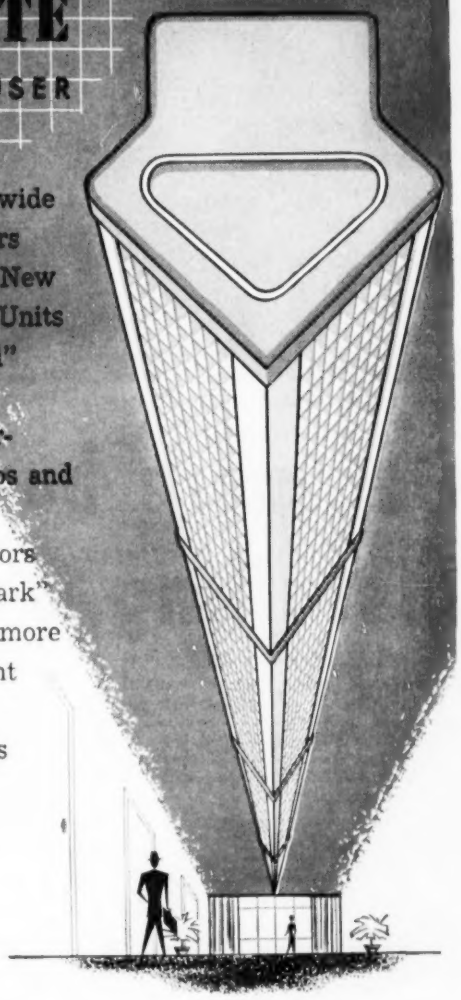
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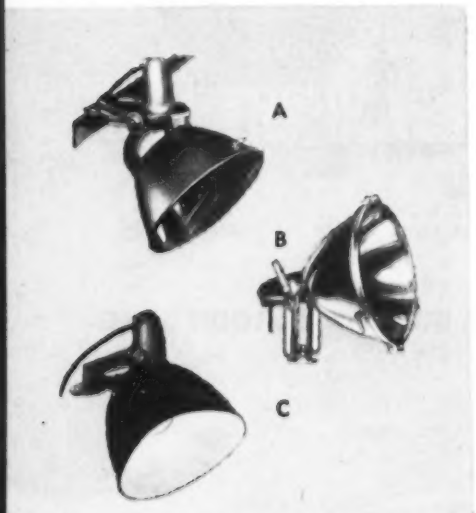
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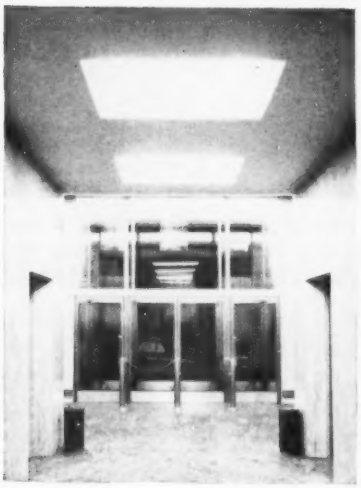
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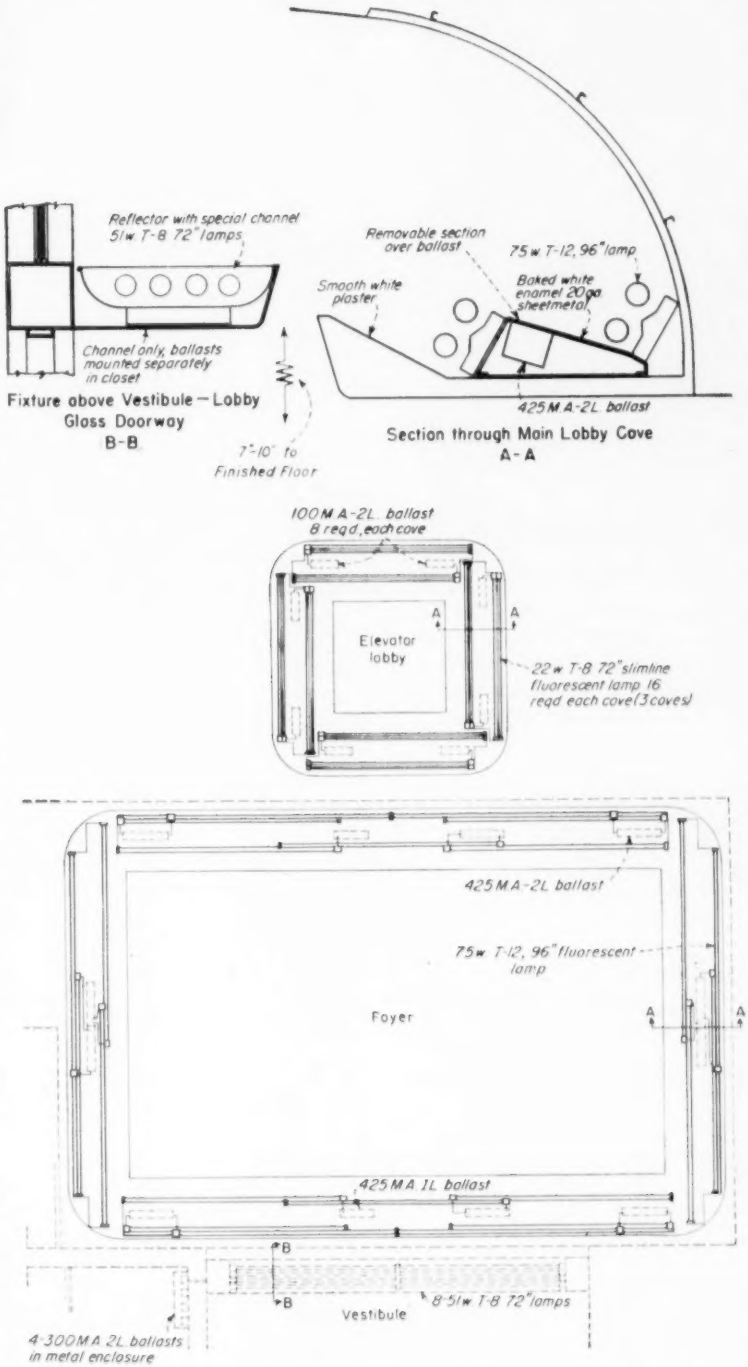
LOOKING from the elevator lobby, through the entrance foyer and vestibule of the Standard Oil of California's San Francisco office building, indicates the various applications of coves above the all-glass electric-beam controlled entrance doors and in ceiling panels.

Coves Contribute To Lobby Attractiveness

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As indicated in Section A-A, the smooth white plaster cove edge sweeps up almost to the level of the upper



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lamps, thereby producing a light cut-off 5½ degrees below the horizontal. Lamp channels are mounted on a white enameled 20-gage sheet metal supporting frame containing removable sections over ballast positions.

A second cove treatment is installed immediately above the all-glass doors in the all-glass partition separating vestibule and foyer. As indicated in Section B-B the inverted reflector is housed in an attractive, narrow, ornamental metal cove, 7 feet above the finished floor. Since ballasts are mounted separately in a metal enclosure located in a closet adjacent to the vestibule, this cove need only be sufficiently deep to shield the reflector and lamps, and the resultant installation is attractively trim in appearance. Lamps, 8 in all, are mounted end-to-end 4 abreast. Lamps are 51-watt T-8s operating at 300-ma through 2-lamp ballasts.

Camera lenses being more critical than human eyes (as most photographers discover to their occasional amazement), the apparently overpowering reflections noticed in the accompanying illustration are actually neither objectionable nor too-obviously noticeable. The installation is an attractive, praise-provoking job.

School Incorporates Variety of Fluorescent Treatments

A wealth of practical lighting and architectural ideas are combined in the John Ashley elementary school recently erected in West Springfield, Mass. Designed to serve the community as a civic center as well as a place of learning, it incorporates classrooms and a kindergarten with an auditorium, gymnasium, library, clinic and cafeteria, all attractively conceived and pleasingly illuminated.

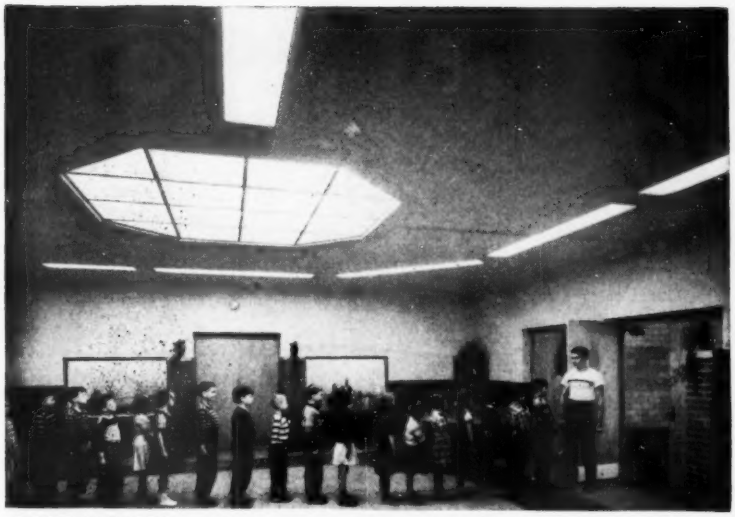
Classrooms—designed for a maximum of 30 pupils and measuring 24-by 40-feet—receive unilateral natural light through prismatic glass block upper walls and awninged windows, and artificial illumination from three continuous rows of 2-lamp fluorescent units surface mounted end-to-end on sloped acoustical ceilings that vary in height between 11- and 8½-feet. Ceilings are slanted in this way to provide a maximum of reflected light to desk tops, floors, chalk- and tack-boards. Fixtures are louvered Wakefield Grenadiers, while lamps are standard cool white T-12s.

Since front chalkboards are angled inwards from exterior windows to interior walls in order to provide even distribution of light and provide good visibility to students in the far corners, classrooms are not perfectly rectangular in shape and fixture rows are not the same length. Therefore two lengths of lamps and fixtures are found, each room illuminated by twenty-four 96-inch and four 48-inch fluorescent tubes.

Average day-time lighting intensities on desks is 80 footcandles. Ceilings are acoustical, flooring in mottled tan asphalt tile, while walls are painted light blues and pale pinks to combine pleasing color values with high reflectance. Also, to provide maximum illumination and working ease to stu-



SLOPING CEILING, tilted tackboards and green glass chalkboards that curve inwards from window line towards interior walls are methods by which maximum light is obtained on desktops and illustration surfaces from the three rows of louvered 2-lamp fluorescent fixtures, windows and glass block upper walls.



CENTRAL LOBBY provides access to gymnasium, auditorium, cafeteria and other important areas. Central skylight, recessed eggcrate-louvered slimline fixtures and shielded 40-watt cool white T-12 lamps above display cases contribute to the pleasing lighting plan that provides between 20- and 100-footcandles.



PLAY AREA for poor-weather use is illuminated by 8- and 4-foot louvered fixtures surface mounted on the white acoustical tile ceiling. Average room intensity is 75-fc while illumination inside lockers measures between 10- and 20-fc. Green asphalt flooring and red brick walls create cheery atmosphere.

dents, tackboards are sloped easel-fashion along interior walls.

When the outside weather is inclement, primary students have the use of an interior play area illuminated to a general level of 75-fc by surface-mounted 8- and 4-foot louvered 4-lamp Smithcraft Directors. Between 10- and 20-fc are recorded inside the light blue lockers that line one wall. Good reflectance from the white acoustical tile ceiling brightens the red brick walls and green asphalt flooring.

A 5-sided lobby at the heart of the school building is a corridor focal point from which direct access is provided to all improtant rooms and areas. This lobby is illuminated partially by a central octagonal skylight in the 9½-foot ceiling, and partially by 5 8-foot and 2 4-foot recessed 2-lamp eggcrate-louvered Smithcraft fixtures. Normal daytime illumination runs from approximately 100-fc beneath the skylight to about 20-fc near the walls of the area.

Illumination for the auditorium, cafeteria and corridors is likewise provided by eggcrate-louvered units in varied layouts.

This progressively-designed school combines the lighting ideas of illuminating engineer Colin Kilburn, and the architectural concepts of Bernhard Dirks, both of Greenfield, Mass. The electrical installation was by the Heyman Electric Company of Springfield, Mass.

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In The News

Minn. Contractors Meet For Silver Jubilee

More than 200 electrical contractors met at the Hotel Nicollet in Minneapolis March 8-11 during the Sixteenth Annual Electrical Industry Convention coordinated through the North Central Electrical Industries. Trade associations representing all phases of the electrical industry held their annual meetings during the four-day conference. Among them were the Minnesota Electrical Association and the Midwest Electrical Council, Inc.

For out-state contractors, this was a memorable meeting. It marked 25 years of progressive service for the Minnesota Electrical Association founded at a 15-man conference in Mankato, May 24, 1928. At that time J. W. Hruska and John Salfer of the Mankato Electric Co., and William A. Ritt, contractor from St. Peter, Minn., initiated the formation of the Southern Minnesota Electrical Association. Five years later, two area groups from the central and western parts of the state joined the southern organization to form the present Minnesota Electrical Association. Today some 281 contractor-dealer firms are association members reaping the benefits of its educational and promotional activities.

All-Industry Session

The four-day convention opened with an all-industry luncheon at which Frank Innes, associate editor, *Electrical World* presented the keynote theme-address "Sell and Sell and Sell." The present rate of spending for defense and industrial plant expansion cannot continue indefinitely. When the decline comes, production of consumer goods will have to be increased considerably to keep our tremendously expanded productive capacity working and the national economy from faltering. Any sign of weakness in our economy will invite attack from those who denounce capitalism, he declared.

The only way to keep men working is to produce more goods and sell more goods. Obligation to sell rests particularly on the electrical industry since post-war expansion in this field has been greater than in any other. Mr. Innes warned that it is no longer enough to meet demands for your products and services, you must create a greater consumer demand for more convenient living.

This general theme was pursued by W. T. Stuart, editor, *Electrical Construction and Maintenance* at the 25th Annual Meeting of the Minnesota Electrical Association. The electrical contractor's challenge is to double the electrical construction share of the building dollar by promoting and selling more adequate wiring systems, more appliances and electrical equipment, he stated. Such a program is entirely in the public interest for only by having proper wiring can the public use and enjoy the vast numbers of electrical devices available. Mr. Stuart characterized the electrical contractor group as the core of this type of industry convention. Wiring is the critical binding force which makes electrical products and services a usable commodity to the consumer, he added.

The electrical contractor has tremendous responsibilities in today's vastly expanding economy, Stuart continued. Over and above the normal job of operating his business he must be kept informed of new equipment and materials, trade sources, prices, area labor situations, advanced technology, legislation and codes. Large corporations have extensive staff facilities to keep management posted on these items. The individual contractor does not. Instead his trade association, with hired talent, provides him with this multiple service. Mr. Stuart pointed out. Major association opportunities lie in an educational and market development program aimed at securing more of the construction dollar for electrical wiring and equipment. Such a program will bring more electrical living convenience to the public and more efficient production to industry.

Association Progress

President Al Kohler of Hibbing recounted the progress made by the Minnesota Electrical Association during the past 25 years, noted the accounting, technical, business and educational aids offered to members. Wm. A. Ritt, who has been secretary-treasurer of the organization since its inception in 1928, noted that many present members are sons of charter members of the group. Our responsibilities to industry and the public are constantly increasing at an accelerated rate, Mr. Ritt stated and added that "bigness" is not measured alone in terms of volume of business but in terms of an overall willingness to support activities which will benefit the industry and the public.



THE REX MOORES, junior (left) and senior, form a happy father and son combination in Sacramento's electrical contracting fraternity. Rex, Jr., was emcee at the annual officers' installation dinner of the Sacramento Valley Chapter, NECA.



A QUICK CONFERENCE following a flight in from Oregon find Hugo E. Becker (left) and Edwin W. Wismer checking progress on an electrical construction project. The co-partners of Wismer & Becker, electrical contracting engineers in Sacramento, California, are engaged in a 4-year joint-venture project installing power house equipment at McNary Dam in Oregon.

Representatives of manufacturers, wholesalers, utilities, inspectors, and educational institutions commended the association on the services it has offered members and public alike during the past quarter century.

At the business session, R. J. Salfer, Mankato Electric Co., Mankato, Minn., was elected president of the Minnesota Electrical Association. Earl Mitchel, Duluth is the vice president; Wm. A. Ritt, St. Peter, secretary-treasurer. Elected to the Board of Directors were: Walter Erickson, Crookston; H. C. Headley, Winnebago; W. P. Crandall, Bemidji; Al Kohler, Hibbing. Regional directors

to the Midwest Electrical Council are: L. A. McClure, Luverne (Western Minn.); John Ellenbecker, St. Cloud (Central); Ed Karst, Fergus Falls (Northwestern); Wm. A. Ritt, St. Peter (Southern); and Al Kohler, Hibbing (Northeastern).

At the 21st annual Meeting of the Midwest Electrical Council, president Moreau Bailey, Albert Lea, traced the development of contractor associations in the state and emphasized the role of the Midwest Electrical Council as a coordinating organizaion serving affiliated groups. Acting secretary Wm. A. Ritt reported on the status of the government suit against electrical industry groups in the area. The case is now in the courts and public interest appears to be quite meager, he noted. The electrical contractor is fighting for the freedom to operate in a business-like manner without interference from any outside source, Ritt added, emphasizing that no contractor has to join the Council nor any other group. He advocated an expanded public relations and sales promotional program plus revision and expansion of the Council's estimating and accounting service.

Following the business session, August Eckel, middle west editor, *Electrical Construction and Maintenance*, presented a series of slides showing how contractors throughout the country are mechanizing their field operations to cut installation costs and provide better service to their customers. Tool conscious contractors have a tremendous advantage over less mechanized competitors, he noted.

An afternoon contractors forum covered the subjects of lighting costs, contractor needs and tax problems. L. E. Johnson, illuminating engineer, Northern States Power Co., Minneapolis, compared lighting costs over the past 25 to 30 years, provided by an actual case history of an installation that more expensive, higher-intensity lighting installations can be economically justified.

While discussing the role of a national trade association, Paul M. Geary, executive vice president, National Electrical Contractors Association, Washington, D. C., outlined some 13 "wants" or "needs" of electrical construction firms. Among them were:

1. "Complete installation service" including furnishing all labor, materials and equipment.
2. Separate awarding of electrical work or a fair bidding procedure to eliminate bid shopping and peddling.
3. Effective opposition to detrimental and effective support of favorable legislation.



CITATION from the Chicago Lighting Institute is made to Lloyd M. Johnson (center), commissioner of streets and electricity for the city of Chicago, in recognition of the improvement in street lighting in Chicago and the future program to complete the project. G. K. Hardacre, Institute president (left), made the presentation as Chicago's Mayor Kennelly looks on. This is the first award ever made by the Institute.

Chicago's present street lighting program is the largest in the world in both mileage and number of units, Mr. Hardacre said in making the presentation. In the last five years 550 miles of streets have been brought up to accepted modern standards with the program one-third completed. Completion of the $67-million program will place Chicago first in the lighting for safety among the large cities of the world.

4. Proper regard by labor for the rights and problems of contractors and arbitration of disputes without work stoppages.
5. Recognition of contractor services by material suppliers in their distribution policies.
6. More business opportunities.
7. Greater influence in development of National Electrical Code and more and better licensing and inspection legislation.
8. A degree of cooperative ethical practice among contractors with due regard for rights of all competitors.

Attainment of these goals cannot be had through individual effort, nor even by independent local or state associations. Only a national organization with a means of making its plans, policies and recommendations effective on a local level can do the job, Mr. Geary pointed out. NECA has the funds and program to fullfil these "wants" but it needs to be able to speak for a larger number of electrical contractors (NECA now has 3,100 members of a possible 10,000 electrical contractors). NECA should be representative of and effective in the other 200 localities it has not yet been able to organize, he emphasized. Every part of the United States must be under the jurisdiction of some Chapter or Branch directly responsible to NECA for carrying out the national program in that area. There is ample evidence to indicate that the desired objectives can be accomplished by a thoroughly coordinated, national federation of local organizations, he concluded.

Timely advice on the solution of the complex tax problems facing business today was given the contractors by E. E. Ranta, attorney and tax consultant of Minneapolis. Considerable interest was evidenced in when to change from partnership to corporation both from the standpoint of limit of liability and tax advantages.

As in past years, there was standing room only at the evening Wiring Codes Session. Prepared questions and spontaneous questions from the floor regarding Code interpretations were answered by a panel consisting of: Glenn Rowell, electrical engineer, Fire Underwriters Inspection Bureau, Minneapolis; Martin Streed, chief electrical engineer, Minneapolis; Ben Lipinski, state electrical inspector; Ray Braun, executive secretary, Minnesota State Board of Electricity and George Reed, electrical instructor at the Dunwoody Industrial Institute. Minneapolis. Revealed at the meeting: A new Minnesota State Code will soon be distributed; the 1953 edition of the National Electrical Code will be available about September first.

At the all-industry lighting session, Dr. S. K. Guth, General Electric Co., Nela Park, reviewed basic research fundamentals which lead to present day lighting practice. H. W. Grosh, Westinghouse Lamp Division, Milwaukee, discussed street and highway lighting principles. R. R. Wylie, Sylvania Electric Products Co., Salem, Mass., reviewed lighting practices for merchandising; noted that, contrary to belief, luminous ceilings provide the most economical form of lighting modernization for stores.

Atlanta Chapter NECA Elect Officers

Henry Barksdale of Whitehead Electric Co., has been elected president of the Atlanta chapter of NECA. Other officers elected included R. W. Allison of Brooks-Allison Electric Co., vice-president; J. H. Hogue of Hogue-Hunter Electric Co., secretary-treasurer, and C. H. Whitehead of Whitehead Electric Co., governor. Charles Kunsman of Fishback & Moore, Inc., Jack Cissey, Electrical Installation Co., were named new directors. J. Ness of Eckardt-Ness Electric Co., is retiring president.

A-W Key to Electrical Growth

The role of Adequate Wiring promotion in sustaining the growth potential of the electrical industry was given new emphasis in Chicago last month. A record turnout of 206 delegates from 28 states attending the 9th annual Adequate Wiring Conference heard a series of speakers representing all branches of the industry cite the need for heightened sales effort.

The fact that progressive electrical contractors (42 attended the conference as against 30 last year) are on the move promotion-wise was brought out repeatedly during the panel discussion, "How Electrical Contractors Build Business through AW Promotion." The participants included: Bruno H. Barg, Barg Electric Co.; Milwaukee, Wis.; Simon Halle, Halle's Elec. Co., Colorado Springs, Colo.; E. B. Oberlander, Oberlander Electric, Peoria, Ill.; George Hickenbotham, Lakeshore Electric Inc., Sheboygan, Wis.; and Carleton J. Bunce, Electri-



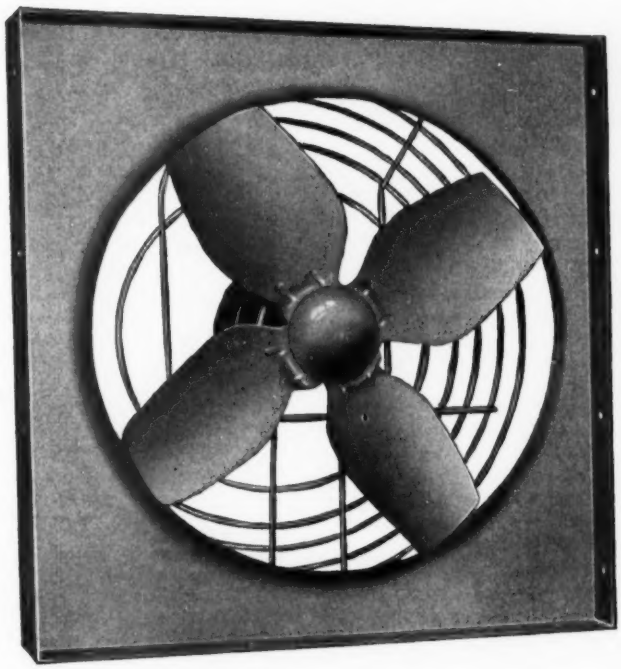
SIMON HALLE, Halle's Electric Co., Colorado Springs, Colo., reports wiring a project of 10,000 homes under construction in Pueblo, Colo. built at the rate of five a week—and all of them are adequately wired.



FRED SCHLEICHER, Pioneer Electric & Sound Co., St. Joseph, Mo., reports the local modernization program has been very profitable.

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E. B. OBERLANDER, Oberlander Electric, Peoria, Ill., says to the qualified contractor, adequate wiring makes a big difference in the quality and value of the job.

cal Contractors' Division, Bureau of Home Appliances of San Diego County, Calif.

They described their own efforts to sell better wiring and unanimously agreed that higher profits and better customer relations were the inevitable results. It was pointed out by several that the idea of cooperative effort through local adequate wiring programs frequently was difficult to sell to contractors. Because of the highly individualistic nature of their work, contractors have been conditioned against joining with others to put across an idea. But with patience, it was emphasized, contractors can be won over to the AW cause.

Wiring modernization can be sold profitably and on a large scale, testified participants in another panel, "Selling the Biggest Market." Representatives from two urban areas, St. Joseph, Mo. and the Quad-Cities, described the mechanics of their programs which have won hundreds of rewiring jobs for contractors averaging $156 in the Quad-Cities and $200 in St. Joseph.

In both cases, the sales approach is identical. Women, on the utility payroll, approach home owners with the AW story. Their leads are obtained from electrical contractors and inspectors, responses to advertising, "no light" calls, applications for building permits. In St. Joseph, where there are 20,000 residential meters, over 2,000 jobs have been sold since 1948. And in the Quad-Cities, where there are 60,000 meters, 1,301 jobs have been sold.

Though skeptical at first, cooperating contractors in both areas now are enthusiastic about the effort, according to the three contractors on the panel—Fred Schleicher, Pioneer Electric & Sound Co., St. Joseph, Mo.; G. O. Farlow, Farlow Electric Co., Moline, Ill.; and H. L. Shaw, Shaw Electric Co., Davenport, Iowa. They said that, among other things, the programs relieved them of time-consuming sales work and much unnecessary traveling between jobs.

Discussing the subject, "Are People Using Too Much Electricity?" keynote speaker A. R. Hines, chairman of the National Adequate Wiring Bureau and G. E. vice president, pointed out that the electrical share of the gross national product should increase from its present level of 3-3½% to 5% in 10 years. "Also," he said, "there are predictions that the residential use of electricity will again double in the next decade."



H. L. SHAW, Shaw Electric Co., Davenport, Iowa, claims it is easy to close the (rewiring) sale with home owners.



GEORGE HICKENBOTHAM, Lakeshore Electric Inc., Sheboygan, Wis., emphasized the selling value of the A-W certificate.

But this rosy sales future hangs on the wiring capacity in America's homes, commercial and industrial buildings, Mr. Hines added. "Our first order of business must be intensive promotion of adequate wiring among professional builders and the public. All branches of the electrical industry must unite to intensify this effort—because today we are certainly putting a strain on the average home wiring system!"

He concluded his presentation with some facts on the size of the wiring market. An additional $2 billion in wiring business alone is a conservative estimate for the old home market. Coupled with this is another $100 million annually for adequate rather than minimum code wiring in the nation's new homes, he said.

The time has come when all branches of the electrical industry realize that consumers cannot continue indefinitely to add electrical appliances to residential systems already close to the elastic limit, said Carl T. Brenicker, vice president in charge of sales, Northern States Power Co. "We can produce all the energy needed to serve new appliances our customers acquire, but how long can the wiring system on the customer's side of the meter take it?"

During 1953, the National Adequate Wiring Bureau will offer a well-rounded program to sell consumers, lenders, home economists, electrical contractors and other industry groups on the importance of up-to-date wiring, said Lester E. Barrett, chairman of the NAWB Plan Committee and president of Barrett Electrical Supply Co., St. Louis. Of special interest is the expansion of the consumer advertising program, which will reach millions of home owners through the pages of "shelter" magazines. The increase, he said, was due to the outstanding success of nominal size ads run in 1952, which pulled an average of 1,000 requests a month for an explanatory booklet.

Mr. Barrett listed as new items scheduled for 1953 production:

A promotional kit for electrical contractors to use in selling better wiring.

Placards for model homes.

A new house sign to identify certified jobs.

Spot announcements for use on TV.

A special folder aimed at financing institutions.

An additional teaching aid for home economists.

About 15% of the appliance dealers in Louisian Power and Light's territory are now telling the adequate wiring story to customers, said J. M. Mooney, wiring consultant for the utility. This reversal of former practices was achieved by making dealers



G. O. FARLOW, Farlow Electric Co., Moline, Ill., says "selling wiring modernization jobs is profitable or I wouldn't do it."

aware of their profit losses through return of appliances from dissatisfied customers, replacement of burned-out motors and excessive service calls, he said.

Joint promotion of adequate wiring and light conditioning really pays off, agreed all participants in the AW-planned lighting panel. When properly merchandised, these features attract great public interest and win demands for repeat performances from builders. In detailing their experiences, several panelists stated that builders are loathe to cooperate when first approached on the idea. But after one venture, they clamored for continued promotional aid on homes so equipped.

Members of the panel were H. H. Brenan, Pennsylvania Power & Light Co., Allentown, Pa.; Robert W. Neel, Cincinnati Gas & Electric Co., Cincinnati; Frank Loula, Northern States Power Co., Minneapolis; E. W. Commery, General Electric Co., Nela Park; Art Jones, Westinghouse Electric Corp., Pittsburgh; and John F. Biggi, National Adequate Wiring Bureau.

College Sponsors Lighting Conference

A conference on Architectural Illumination, covering a broad scope of the various aspects of light, vision and lighting application was held February 27-28 at North Carolina State College, Raleigh, N. C. Intended primarily for local architects and students of architecture at the school, the two-day meeting was also attended by consulting engineers, electric utility lighting engineers and wholesalers' lighting salesmen from the entire Piedmont section of the State. Registration was 85 for the four-session affair, sponsored by N. C. State's School of Design of the Department of Architecture, and Extension Division.

The first session was opened by Dean Henry L. Kamphoefner, of the Department of Architecture, who outlined the scope and purpose of the conference. His opening statement was followed by the rapid showing of about 75 slides in random order, and comments by all participants on their own slides, to indicate to those in attendance the general nature of the conference.

The first speaker was R. P. Bell, Asst. General Paint Manager of the Pittsburgh Plate Glass Co., who spoke on "Color, Light and Living". He explained the physics of color, and how color can be used most effectively in decoration, as an adjunct to lighting and visual efficiency, and as a safety measure in industry. He also demonstrated the effect of various spectral

WATER COOLERS



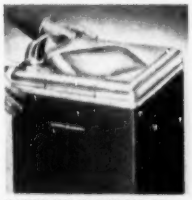
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The second speaker was Charles R. Kelley, Asst. Professor of Psychology and Associate Director of Occupational Vision Research, N. C. State College, who discussed "Illumination and Visual Perception." His talk involved the eye as a perceptory organ, and the effect of light on the eye under varying degrees of brightness, size of light source, and contrast, and a visual demonstration of some of these effects.

A highlight of the Conference was the second session, in which three speakers, each prominent in his own professional field, gave his viewpoint on the art of lighting. First speaker was Richard Kelly, lighting designer and engineer, New York City, who discussed "The Meaning of Light in Architectural Design". He told how light can be used to produce a focal glow, ambient luminescence, or play of brilliants, and demonstrated each by lantern slides, all showing a purposeful application of light as a part of architectural design.

"Lighting Design Objectives" was the subject of the viewpoint on the art of lighting presented by C. M. Cutler, illuminating engineer with General Electric Co., Nela Park, Cleveland. Mr. Cutler showed, by means of colored lantern slides, how light is applied in industry, retail establishments, offices, schools, the home, and elsewhere to provide maximum visual comfort, to highlight merchandise, and as a dramatic medium of decoration, especially as applied in restaurants, theatres, night clubs, and the four World's Fairs of the past two decades held in this country.

Louis I. Kahn, Philadelphia architect and Chief Critic in Architectural Design at Yale University, spoke on "The Relation of Light to Form". Using the fields of housing and city planning, he demonstrated his lecture by drawings on the blackboard, and by a series of slides showing various studies and works executed in his own offices. He made a plea for more frankness in design. "Let a valve be a valve", he said, and applied this philosophy to light and lighting units.

The third session consisted of a panel symposium to resolve new problems of lighting in architecture. Speakers from all four sessions, plus local architects and engineers, formed the panel, and the entire audience participated freely in these discussions. Mr. Kelly presented the problems existing in many fields of lighting application, such as the use of large areas of glass in modern structures, the attempt to use both artificial and natural lighting in school classrooms, the need for general and local lighting in industry, the lighting of sales areas, etc., and was ably assisted by Mr. Kahn who gave the architect's viewpoint. A broad range of subjects was covered, and various viewpoints were expressed by the panel and by the audience.



MY BEST SALESMAN asserts W. C. Schlosser, president, Capital Electric Co., Madison, Wisconsin, as he points to a recording watthour meter. He's referring to the effective way in which graphic instrument surveys can uncover electrical system ills and convince management that modernization is in order.

The fourth and last session was devoted to methods of lighting design procedure and sources of information. C. M. Cutler gave an illustrated talk on light sources, light control, methods of preparing lighting layouts and how to use various lighting equipment designs.

Final speaker for the four-session conference was Berlon C. Cooper, Eastern Editor for *Electrical Construction and Maintenance*, who presented a "General Bibliography of Natural and Artificial Light Study, Research, and Writing". This bibliography was prepared in advance and was reproduced by the School of Design and made available to all in attendance.

Henry L. Kamphoefner, Dean of N. C. State's Department of Architecture, presided at all sessions and served as moderator for all panel and audience discussion periods.

NISA News

The New England Chapter held its regular monthly meeting at the Hotel Bradford, Boston, on February 12. President Harry Bedig presided at the meeting, at which there were 34 members present.

The membership committee reported that an application had been received from the Robert Spears Company of 82 Sudbury St., Boston, Mass. This company was then voted in as an active member.

Al Elson reported on NISA News and the National Convention to be held in New York next May. It was voted not to advertise as a unit in the May issue of NISA.

The program consisted of a panel discussion by members, with Fred Ferris acting as chairman, on Salesmen's Compensation—Salary or Commission. Dave Sandman started the proceedings and a spirited discussion followed on the pros and cons, with several of the members expressing the arrangements in regard to their own business. Consensus of members present was that this type of discussion could be carried into future meetings for added interest.

• • • •

The meeting of the Los Angeles Chapter took place on February 10 with an attendance of 37.

Mr. Sweinhart, called attention to NISA News and the National Award Contest.

A motion was made by Mr. Katz, to have a member sent to the National Convention, sponsored by the chapter. The motion was seconded by Mr. Hoag. A vote was taken and the motion defeated.

Mr. Sweinhart called on Mr. Pompey to introduce the speakers of the evening, Mr. Graham and Mr. Bailey, National Anti-Friction Bearing Co. Two films pertaining to ball bearings were shown, one covering the manufacture, the other the handling and care of all bearings.

• • • •

Meirer Electric & Machine Co., Indianapolis, has sold its motor division to Alvin C. Brehob who will operate the business as "Brehob Electric Equipment, Inc." Hereafter the Meirer firm will confine its activities to manufacturing of fans and similar products.

• • • •

Active members of NISA employ a total of 11,610 persons, an average of 9.12 employees per shop, as reported in the 1952 Membership list.

• • • •

Frank Schaef, secretary, Quaker City Chapter, reports that his group has been devoting half of its meetings to floor discussions of shop problems and half to outside speakers on subjects of technical interest to shop owners. "Our last meeting", he writes, "didn't break up until nearly midnight, and our attendance has been very good. Possibly, we have found an answer to that all-important problem of keeping the membership interested to the point where they will attend regularly."

• • • •

The Great Lakes Chapter held one of its most successful meetings in January at Don Blackburn & Co. with over 100 persons attending. Buffet supper was served and was followed by the group's business meeting. National President Rudy Scherer spoke to the group on the benefits of NISA membership. Cutler-Hammer Co. was represented by a speaker and display of their new line of starters.

• • • •

The Northern California Chapter met on February 2 at the El Jardin Restaurant, San Francisco. Seven were present. The group is planning an "Old Timers Night" and is also arranging for a special meeting for its members to meet National President Rudy Scherer.

• • • •

Plans for the forthcoming NISA Convention are taking definite shape. Principal speaker for the convention will be Clayton Rand of Gulfport, Miss. The topic of his speech has not been determined as yet, but there are indications that it will be timely, interesting and witty.

Mr. Rand was born in Wisconsin and reared in Mississippi, attended Harvard Law School, practiced law in Mississippi and now owns and edits *The Dixie Press* and *The Dixie Guide* at Gulfport, Mississippi. A past president of Mississippi State Press Association, National Editorial Association and active in many other organizations.

From Walter J. Prise, The Maintenance Co., New York, N. Y.

IES Holds Annual Regional Conferences

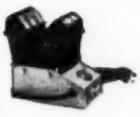
Eight annual Regional Conferences highlight the spring activity of the Illuminating Engineering Society, supplementing its regularly scheduled monthly meetings, sponsored by its 54 Sections and Chapters spread across the United States and Canada. These Regional Conferences are now in full swing, and provide an opportunity for lighting engineers, architects, electric utility men, wholesalers, contractors and others to meet in technical and social sessions to discuss their local lighting problems at the regional and local level. These two-day Conferences are jammed with technical papers presented by eminent national and local lighting men, with the programs stressing special lighting problems of particular interest to local membership.

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This new, sturdy, portable instrument has 5" meter,—Four testing ranges: Volts, AC and DC: 0-10.0-50, 0-250, 0-1000, AC only: 0-2.5: Amperes, DC only: 0-10; Ohms: 0-1000, 0-10000; Megohms: 0-1, 0-100. Selector Switch provides four positions: Volts AC, Volts DC, Ohms, Amps. Range Switch has 5 positions which provide for above Voltage ranges, 4 ohm ranges, and 1 ampere range. 4' test lead has both prods and alligator clips. Has sturdy, leather carrying case.

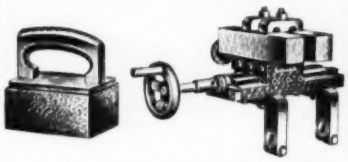


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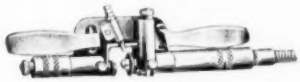
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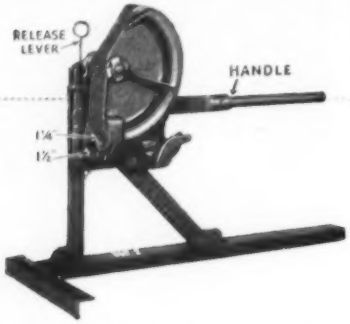
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The spring Conferences got under way when the tenth Canadian Regional Conference convened at Chateau Laurier, Ottawa, Ontario, March 23 and 24. Nine technical papers were presented by eminent speakers from Canada, England and the United States. This was followed by the Pacific Northwest Regional Conference, held at the Hotel Benson in Portland, Oregon, April 2nd and 3rd, and by the South Pacific Coast Regional Conference in Los Angeles, Calif., on April 9th and 10th.

Other Conferences to be held are as follows: Southwestern Regional Conference, Hotel Baker, Dallas, Texas—April 12-14; Midwestern Regional Conference, Hotel Radisson, Minneapolis, Minn.—April 30-May 1; East Central Regional Conference, Hotel Lord Baltimore, Baltimore, Md.—May 14-15; Southern Regional Conference, Sedgfield Inn, Greensboro, N. C. —May 18-19; and Great Lakes Regional Conference, Syracuse Hotel, Syracuse, N. Y.—May 25-26.

The 1953 National Technical Conference, a four-day affair, will be held at the Hotel Commodore, New York City, September 14th to 17th inclusive, which is expected to attract about 1000 lighting men from across the country, Canada and abroad.

Of special interest to all in the field of lighting application will be the regional run-offs of entries in an IES-sponsored "Most Interesting Lighting Job" contest. Winners at the Section and Chapter levels have already been selected, and these winners compete in the regional run-offs. Regional winners will in turn go to the National Technical Conference in New York next September for the final judging. Each contestant describes his own most interesting lighting job, and tells why it is an interesting job, what the lighting problem was, what lighting systems or equipments were considered for use, and how it was finally lighted.

Another highlight of many of the Regional Conference programs and of the National Technical Conference is the Lighting Progress report which includes recent developments in light sources, lighting equipment and application in all phases of lighting.

Pioneer Contractors Get 50-Year Awards

Each year the North Central Electrical Industries, coordinator of the Annual Electrical Industry Convention in the Twin-Cities, honors industry members who have completed fifty years of service in the electrical field. Those so honored become Golden Jubilee Pioneers.

Two electrical contractors were among the 10 industry members singled out for the 1953 class of "Pioneers":

John Salfer of the Mankato Electric Co., Mankato, Minn. Mr. Salfer, one of three men instrumental in the organization of the Minnesota Electrical Association (out-state contractors) 25 years ago, started his career in the electrical field as an electrician apprentice in Hausham, Bavaria, in 1902. When he came to the United States in 1909, he took a position with the Consumer's Power Company in Mankato. Three years later he moved to Milwaukee and worked for the street railway company. In 1915 he returned to Minnesota and with a partner obtained a franchise for the three towns of Truman, Lewisville and Hanska. They constructed 30 miles of high lines and built and operated the electric distribution system. In 1920, Mr. Salfer sold his interest in this enterprise and bought a half interest in the Mankato Electric Co. (contractor). In 1925, J. W. Hruska purchased an interest in the Mankato firm and together they operated the company until 1946 when Mr. Hruska retired and Mr. Salfer's son Rudy became a partner.

John W. Keyser is a certified electrical inspector at Slayton, Minn. In 1900 Mr. Keyser started in the electrical industry with the Alden Telephone Company in Alden, Iowa. During the next ten years he worked as a wireman for a number of Iowa firms, then started his own electrical contracting business. In 1913 he was appointed construction foreman and superintendent of the Municipal Light Plant at Livermore, Iowa. He accepted a similar position with the Iowa Heat Light and Power Company at Sandborn in 1917. From 1924 to 1932 he was district superintendent for Northern States Power Company at Slayton, Minnesota. Then he returned to electrical contracting.

Other recipients of the 1953 awards are: A. P. Dienhart, recently retired manager of Western Electric products, telephone sales and signalling equipment sales for Graybar Electric Company. Weaver Lynn Fowler, president, Square F Supply Company, Cedar Rapids, Iowa. Henri E. Gable, manager, lighting fixture department, Northland Electric Supply Company, Minneapolis. C. S. Rygh of the City Light and Power Plant at Miller, South Dakota. Frank R. Dolan, retired district manager, Paranite Wire & Cable Co., Chicago. George W. Hemingway, manufacturers' representative, Minneapolis. Walter H. Vilett, president, Northland Electric Supply Company, Minneapolis. George Wold, retired meter inspector for the State of Minnesota, St. Paul.

DATES AHEAD

International Association of Electrical Inspectors—Georgia Chapter, Hotel DeSoto, Savannah, Ga., April 13-14; Florida Chapter, Soreno Hotel, St. Petersburg, Fla., April 16-18; North Carolina Chapter, Carolina Hotel, Raleigh, N. C., April 21-22; South Carolina Chapter, Columbia Hotel, Columbia, S. C., April 24-25; North Louisiana, East Texas and Texas Gulf Coast Chapters joint meeting, Baker Hotel, Dallas, Texas, May 1-2; Virginia Chapter, George Mason Hotel, Alexandria, Va., May 18-19.

Chamber of Commerce—Annual meeting, Washington, D. C., April 26-29.

Industrial Trade Show—Sponsored by the Electric Association of Kansas City, Exhibition Hall, KMBC Building, Kansas City, Mo., April 28-30.

Chicago Electrical Industry Show — Sponsored by the Electric Association and the Electrical Maintenance Engineers of Chicago, Conrad Hilton Hotel, Chicago, May 11-14.

National Fire Protection Association—Annual meeting, Palmer House, Chicago, Ill., May 18-22.

Electrical Manufacturers Representatives Assn. of Michigan—Electric exhibit, Exhibition Building, Michigan State Fair Grounds, Detroit, Mich., May 19-22.

National Industrial Service Association—Annual convention, Hotel Statler, New York City, May 24-28.

National Association of Electrical Distributors—45th annual convention, Conrad Hilton Hotel, Chicago, Ill., May 24-28.

Edison Electric Institute—21st annual convention, Atlantic City, N. J., June 1-4.

Fourth National Store Modernization, Building and Maintenance Show—Madison Square Garden, New York City, June 9-12.

American Institute of Electrical Engineers—Summer general meeting, Atlantic City, N. J., June 29-July 3.

N. Y. State Electrical Contractors and Dealers, Inc. — Annual convention, Saranac Inn, Saranac Inn, N. Y., June 29-July 3.

Illuminating Engineering Society — Hotel Commodore, New York, N. Y., September 14-18.

International Association of Electrical Inspectors—25th Jubilee meeting, Edgewater Beach Hotel, Chicago, Ill., September 21-26.

National Electronics Conference — 9th Annual conference, Hotel Sherman, Chicago, Ill., September 28-30.

Industrial Electric Exposition — Hotel William Penn, Pittsburgh, Pa., October 6-8.

Canadian Electrical Manufacturers Assn. — Annual meeting, General Brock Hotel, Niagara Falls, Ontario, Canada, September 23-25.

National Electrical Manufacturers Assn.—Haddon Hall Hotel, Atlantic City, N. J., November 9-12.

National Electrical Contractors Association—Annual convention, Miami Beach, Florida, November 17-20.



JAMES DANDELAKE has been elected president and general manager, and chairman of the board of directors of Miller Electric Co., Jacksonville, Florida, Miller Electric Company of the Carolinas, Columbia, S. C., and Jacksonville Metal & Plastics Co., Jacksonville, Fla. He succeeds the late Henry G. Miller, president and founder of these corporations. Mr. Dandelake has been associated with Miller Electric Co. for the past 17 years, serving in the capacity of vice president.

Among the Manufacturers

Headquarters Announcements

Corning Glass Works, Corning, N. Y. —Campbell Rutledge, Jr., assistant general manager of the electrical products division.

The Lau Blower Company, Dayton, Ohio.—Edward V. Sullivan, sales manager of the fan division.

Benjamin Electric Mfg. Co., Des Plaines, Ill.—announces purchase of the Leader Electric Co., Chicago, and formation of the Leader Division of the Benjamin Elect. Mfg. Co.

The Electric Products Co., Cleveland, Ohio.—William J. Bergen, manager of merchandise sales.

Sylvania Electric Products Inc., Salem, Mass.—Charles I. Brady, Jr., sales manager of the fluorescent fixture department.

The Electric Products Co., Cleveland, Ohio.—Dr. W. A. Thomas, Chief Engineer.

Johns-Manville Corp., New York, N. Y.—Louis F. Frazza, staff manager of the Transite pipe dept.

Westinghouse Electric Corp., Pittsburgh 30, Pa.—James O. Clevenger, sales manager of general industrial products.

Precision Welder Mfg. Co.,—announces the formation of Precision Transformer Corp.

Sprague Electric Co., North Adams, Mass.—Leon Podolsky, technical assistant to the president.

Wheeler Insulated Wire Co., Inc., Waterbury, Conn.—Dawson J. Burns,

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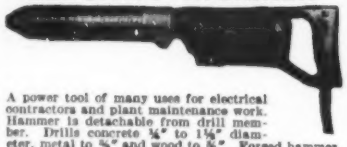
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president; George B. Horn, vice president and general manager.

T. J. Cope, Inc., Philadelphia, Pa.—A. M. Sanson Jr., sales manager.

Snap-Tite, Inc., Union City, Pa.—Armand A. Probeck, vice president.

Regional Appointments

MIDDLE ATLANTIC

Sylvania Electric Products, Inc.: John B. Muller, Eastern regional sales manager for the lighting division, New York, N. Y.; Frederick W. Fulle, district sales manager, New York City, lighting division.

Sterling Engineering Co., Inc., W. Henry Cordway, Philadelphia, Pa., representative for eastern Pennsylvania, southern New Jersey, Maryland, Delaware and the District of Columbia.

General Electric Company: Dale L. Kuneman, New York, N. Y., district manager for the Major Appliance division.

Pittsburgh Reflector Company: Edward C. Muller, sales and engineering representative for fluorescent and incandescent lighting, New York, N. Y.

SOUTH ATLANTIC

S & M Lamp Co.: C. C. Myrick, Atlanta, Ga., representative for Tennessee, Alabama, Georgia and South Carolina.

Westinghouse Electric Corp.: Thomas Fuller, Jr., manager of the new Atlanta, Ga., branch office.

Allis-Chalmers Mfg. Co.: Richard R. Goetz, Franklin B. Gregersen and Howard F. Ricker, installation superintendents, and Robert R. Whitehead, service representative, Atlanta, Ga.

EAST CENTRAL

Rockbestos Products Corp.: Edward J. Parker, district sales manager for St. Louis; Edward J. Langhenry, sales representative in the Chicago district office; John A. Stefon, Jr., office and warehouse manager of the Chicago district office.

National Electric Products Corp.: Arthur J. Spivringer, surface raceway specialist for Michigan, Ohio and West Virginia.

Pittsburgh Reflector Company: Bennett H. Williams, sales and engineering representative for fluorescent and incandescent lighting, Huntington, West Virginia; A. E. Grawemeyer, representative for fluorescent and incandescent lighting, Memphis, Tenn.

Electric Service Mfg. Co.: Warren Erbe, district manager of the St. Louis, Mo., office.

WEST CENTRAL

Graybar Electric Company: H. E. Orr, operating manager of the Amarillo, Texas, branch office.

WEST

Square D Company: Dan Miller, district manager for the northwest territory, Los Angeles, Calif.

Sylvania Electric Products, Inc.: Robert C. Harper, sales manager for the Los Angeles district; William L. Friend, sales manager for the San Francisco district, both with the lighting division.

COVE LIGHTING TECHNIQUES

[FROM PAGE 75]

flector, wiring channel and mounting details, as shown in Sketch B. Detailing the structural construction of the cove and its outer ornamentation thus becomes a straight design job.

Selection of the proper light distribution, and hence of the proper reflector, to light the cove evenly is a problem of analyzing the candlepower curve and the effect of reflection from the interior of the cove plus direct light from the lamp itself. The greatest fault with most cove lighting jobs is that too much light is produced on the back wall and on the ceiling immediately above the cove. Therefore it is usually desirable to select reflectors or reflector lamps which have the greatest "punch"; that is, that have a highly intensive beam. Because filament lamps are point sources of light, they provide the best means for accurate light control, and are therefore generally more suitable.

Fluorescent lamps are inherently diffuse type of light sources, and are suitable for cove lighting where diffuse or wide angle light distribution is applicable. When concentrated beam control is desired as well as the use of fluorescent lamps, it is recommended that small diameter T-8 fluorescent lamps be used in continuous specular parabolic type reflectors, such as is shown in Chart III, Sketch A. Variations of the parabolic type reflector are shown in Sketches D and E, Chart III. Sketches C and G in Chart II and Sketch A in Chart III show how the apparent size of the cove may be reduced by recessing the reflectors in the wall.

Sketches B and C in Chart III show the use of bare fluorescent lamps in an open cove. In such cases, the center of the lamp from the wall (distance X) should be at least 4 inches, to prevent undue brightness on the back wall above the cove.

A wide variety of cove lighting reflectors and design techniques are available, as indicated by the sketches. Many times equipment designed for other purposes can be adapted to cove lighting most effectively. The growing range of sizes and lighting distributions of reflector lamps offers a new cove lighting tool. And shown in Chart I is a special prismatic glass lens unit used to cove light the domes in the House and Senate Chambers of the U. S. Capitol building, in Washington, D. C., which shows how special light distribution patterns can be utilized for cove lighting purposes.

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Amount	Make	Item	Type
440 ft.	West. Elec.	51 Pr. #19	PILC
450 ft.	Okonite	6 Pr. #19	PILC
481 ft.	Okonite	4 Pr. #16	PILC
910 ft.	West. Elec.	51 Pr. #19	PILC
890 ft.	West. Elec.	26 Pr. #19	PILC
500 ft.	Okonite	10/c #14	Neoprene Sheath WP Braid
788 ft.	Okonite	7/c #14	Neoprene Sheath WP Braid
1750 ft.	Okonite	5/c #14	Neoprene Sheath WP Braid
140 ft.	Gen. Cable	26 Pair	PILC
477 ft.	Copper Weld	7/c #14	Rubber & Braid
600 ft.	Okonite	10/c #14	Neoprene Sheath WP Braid
875 ft.	Okonite	10/Pr. #19	Okonite Okoprene Twisted in Prs.
225 ft.	Okonite	2/c #14	Rubber & Braid
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which of these feed-in duct features *rate highest with you?*



architects

rate these SQUARE D features particularly high:

lowest known voltage drop . . . maximum efficiency, minimum power loss

smallest cross-sectional area . . . conserves valuable installation space



contractors

give these features top billing:

reduced installation time . . . simplified components, factory prefabrication

new joint design *(lower right)* . . . all joint ends identical, connection bolts face outward

interchangeable standard fittings . . . permit horizontal or vertical riser applications



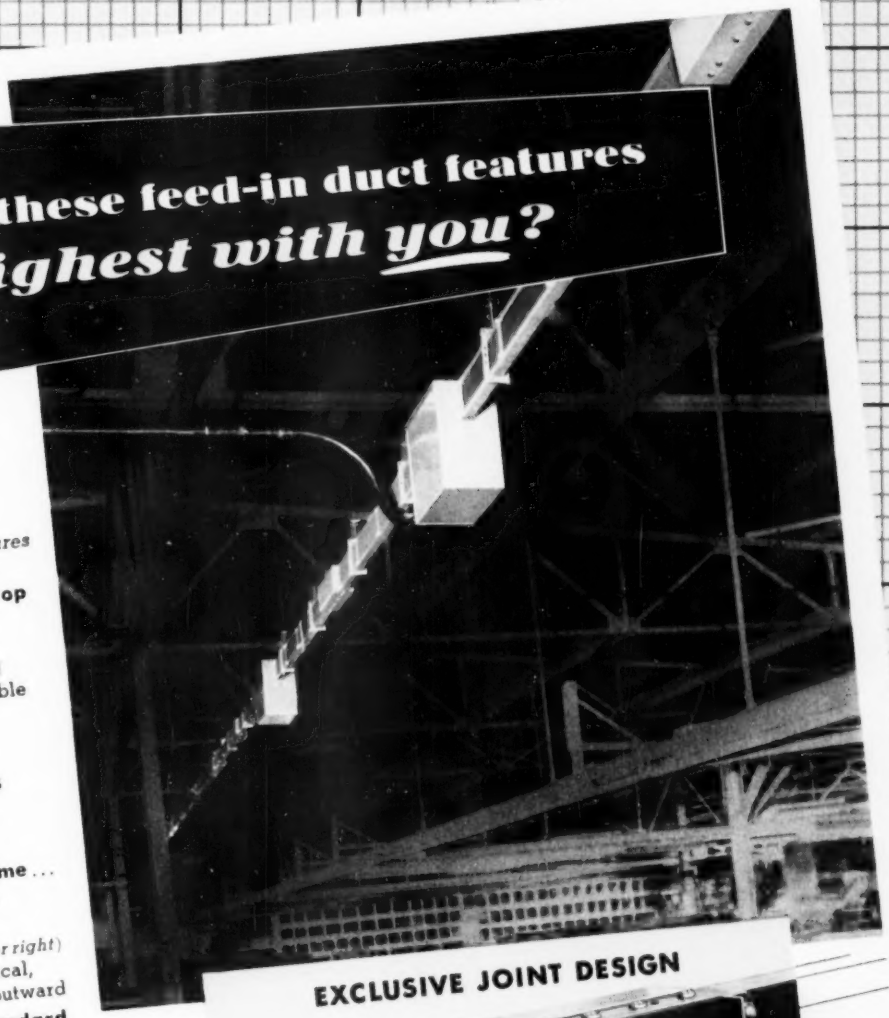
users

vote these SQUARE D features tops:

low cost installation and maintenance . . . most accessible connections

totally enclosed . . . permanent safety construction, excludes dust

completely reuseable . . . rearrangement with the same components

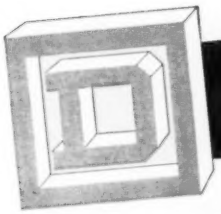


EXCLUSIVE JOINT DESIGN



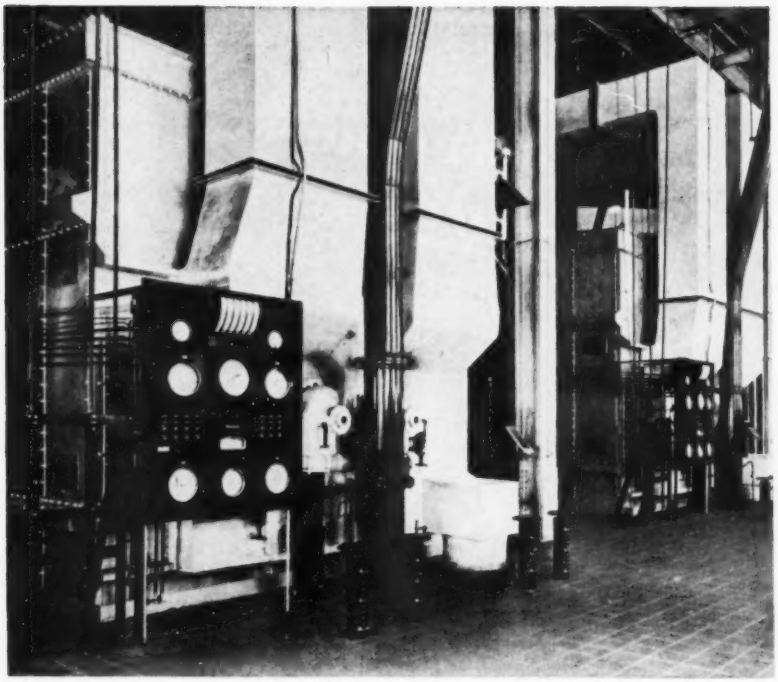
SQUARE D's exclusive joint design saves installation time and reduces maintenance cost. Joint ends are identical—unnecessary to select mating ends before positioning or hanging duct sections. Outward-facing, pre-installed bolts permit rapid assembly and easy maintenance.

ASK YOUR ELECTRICAL DISTRIBUTOR FOR SQUARE D PRODUCTS



SQUARE D COMPANY

1903 · **50** YEARS OF DESIGN LEADERSHIP · 1953



For every high-temperature wiring need use G-E Deltabeston* wire or cable

You can simplify the selection of exactly the right wire or cable for any hot-location wiring job by calling on your G-E Construction Materials distributor. He can quickly help you to select the proper cable from the complete range of G-E cable sizes and insulations for average or extreme heat conditions; for use where moisture, oil, or corrosive vapors may be present; or where abrasion must be considered.

Your G-E distributor thus provides a single source from which you can obtain all sizes of Deltabeston power cables, apparatus leads, boiler room wires, and station control cables.

For rewinding motors

On Class H (180 C hot-spot temperature) motor rewinding work you can build a solid reputation for quality work by using G-E Deltabeston magnet wire. It is available in all sizes of round or rectangular shapes with asbestos or glass insulations.

For more detailed information see your G-E Construction Materials distributor, or write to Section W75A-418, Construction Materials Division, General Electric Company, Bridgeport 2, Connecticut.

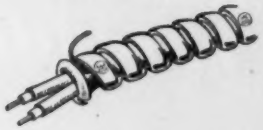
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1878 75 1953 YEARS OF ELECTRICAL PROGRESS

GENERAL ELECTRIC

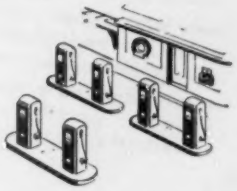
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Geotrol meets U. L. requirements for Gasoline Filling Stations: G-E Geotrol wire is a gasoline- and oil-resistant wire especially designed for electrical circuits to gasoline pumps and for control circuits in oil refineries and bulk plants. It makes unnecessary the use of expensive, bulky, leaded cable.



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